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Peach and Nectarine Growing In California

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PEACH AND NECTARINE GROWING IN CALIFORNIA[1]

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INTRODUCTION

PEACHES AND NECTARINES are very much alike. The trees differ in no essential respect from each other in appearance, growth responses, bearing habits, or other general characteristics. Only the absence of pubescence, the usually smaller size, the greater aroma, and the distinct and richer flavor of the nectarine distinguish it from the peach. Both fruits have freestone and clingstone sorts that may be red, yellow, or white fleshed. Leaves of nectarines show all the variations in glands and serrations found in the peach; the flowers vary similarly in size and color; the stones and kernels cannot be distinguished.

The history[4] of the nectarine goes back for 2,000 years and then merges into that of the peach; its origin is unknown. The nectarine is one of the most interesting phenomena in horticulture. Cases have been reported of nectarines coming from peach seeds, of peaches coming from nectarine seeds, of peach trees producing nectarines by bud sports, and of nectarine trees producing peaches in a similar manner. There are records of trees bearing individual fruits that were half peach and half nectarine. Recently[5] a nectarine has been reported arising as a bud sport from a Greensboro peach tree.

Because of the similar response of peaches and nectarines, the present discussion will apply generally to both fruits; only acreage, varieties, and harvesting of nectarines are treated in separate sections at the end of this circular.

The soil and climatic conditions found in the peach-growing areas of California are favorable to the production of large crops of satisfactory fruit. The peach tree thrives in a well-drained type of soil of medium texture. Given sufficient plant food, especially nitrogen, it will also do

[1] This circular supersedes Extension Circular 42, *Peach Culture in California,* by E. L. Overholser and W. P. Duruz.

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[4] Hedrick, U. P., *et al.* The peaches of New York. Report of New York [Geneva] Agr. Exp. Sta. Report 1916. Part II. xiii+541 p. 1917.

[5] Dorsey, M. J. The bud sport situation in pomology. Illinois [State] Hort. Soc. Trans. 67:212. 1933.

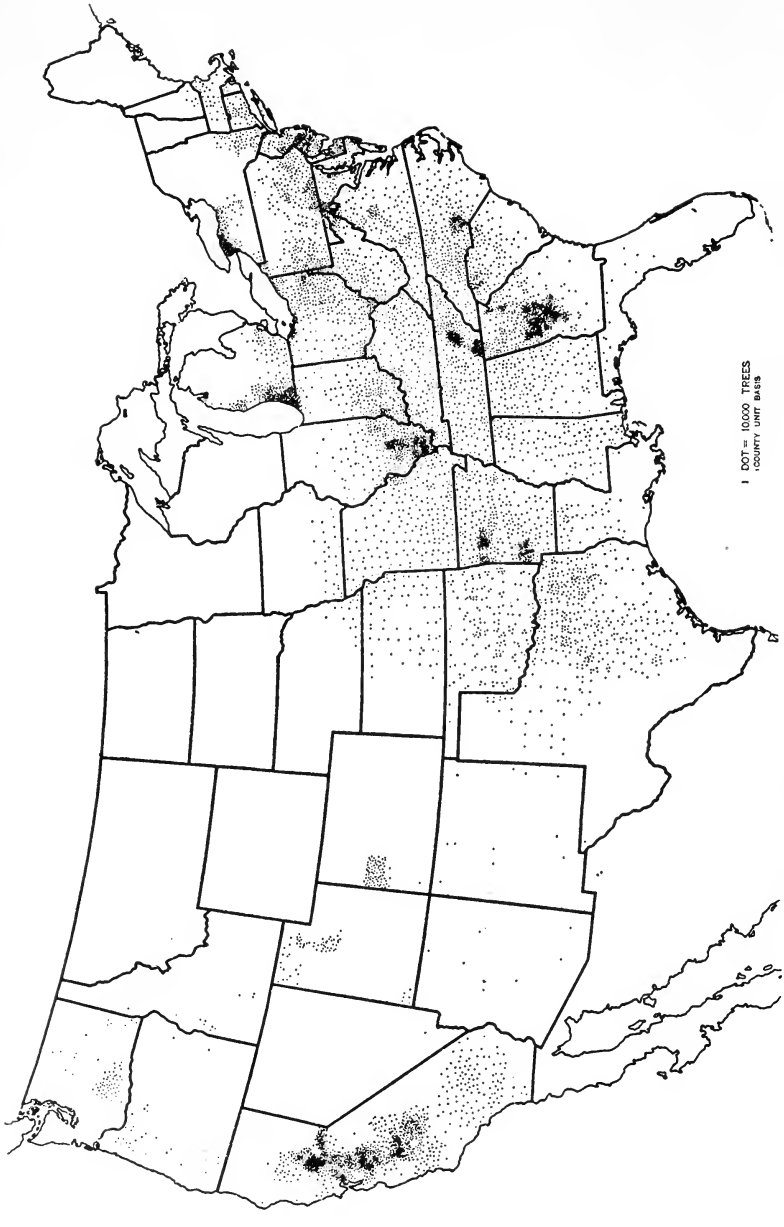

Fig. 1.—The distribution of peach trees of all ages in the United States in 1930. (From U. S. Census, 1930.)

well on a very light, open, sandy type. If the soil is not too compact, wet, and heavy, there is a wide range of soils upon which the tree will thrive. It is not tolerant of alkali soils.

The climatic conditions of the interior valleys are well suited to the production of this fruit. The peach does well with low humidity, abun-

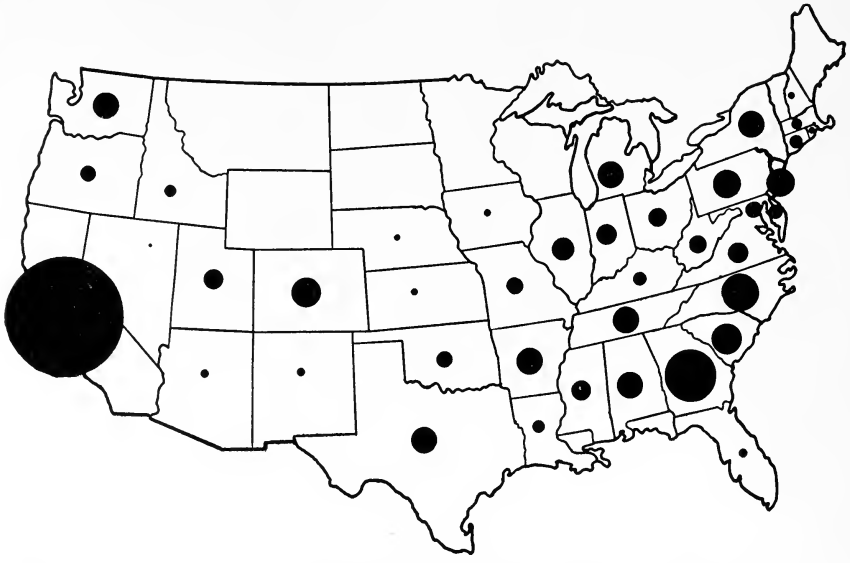

Fig. 2.—Distribution of average annual production of peaches, 1932 to 1934, in various states. (California average=21,813,000 bushels, or 523,512 tons.)

dant sunshine, and rather high temperatures during the growing season. In the peach-growing areas of California winter temperatures almost never become low enough to do any damage. Spring frosts, however, may be harmful. Many varieties are susceptible to delayed foliation and they probably cannot be grown at a profit south of the Tehachapi Mountains. Only varieties having a light rest period seem suited to areas having warm winters.[6]

STATUS OF PEACH GROWING IN CALIFORNIA

California[7] has a rather small percentage of the total number of peach trees in the United States: in 1930 about 15 per cent of trees of all ages and 17 per cent of the bearing trees (fig. 1). From 1932 to 1934 almost half of the total national production was grown here (table 1 and fig. 2).

[6] Weldon, Geo. P. Fifteen years study of delayed foliation of deciduous fruit trees in Southern California. California State Department of Agriculture Monthly Bulletin 23:160–181. 1934.

[7] For a complete discussion of this phase of the peach industry, the reader is referred to: Wellman, H. R. Supply, demand, and prices of California peaches. California Agr. Exp. Sta. Bul. 547:1–64. 1932; and to the reports of the California Coöperative Crop Reporting Service.

Practically the entire United States tonnage of canning and drying peaches is produced in California. On the average only about 8.5 per cent of the national production of fresh peaches originates here, and this represents about 13 per cent of the crop of the state.

The very high prices paid for canning peaches during and immediately after the World War stimulated heavy planting of the clingstone

TABLE 1

UNITED STATES PRODUCTION OF PEACHES BY STATES, 1932 TO 1934*

State	1,000 bushels			State	1,000 bushels		
	1932	1933	1934		1932	1933	1934
New Hampshire	20	18	0	South Carolina	792	1,633	1,610
Massachusetts	166	134	2	Georgia	1,170	5,440	5,610
Rhode Island	44	26	2	Florida	28	57	68
Connecticut	215	172	2				
New York	1,663	1,092	41	Kentucky	79	216	434
New Jersey	1,776	987	22	Tennessee	300	580	2,325
Pennsylvania	1,676	1,144	442	Alabama	221	908	1,089
				Mississippi	132	494	781
Ohio	814	456	228	Arkansas	352	672	1,848
Indiana	106	221	192	Louisiana	91	158	198
Illinois	188	1,522	528	Oklahoma	280	108	612
Michigan	1,845	215	517	Texas	792	782	1,287
Iowa	76	7	53				
Missouri	102	204	468	Idaho	178	51	93
Nebraska	58	4	5	Colorado	1,201	578	1,260
Kansas	50	14	90	New Mexico	44	13	123
				Arizona	83	67	48
Delaware	227	205	64	Utah	748	62	558
Maryland	348	400	82	Nevada	4	2	6
Virginia	324	990	414	Washington	1,320	240	1,200
West Virginia	143	396	110	Oregon	348	227	314
North Carolina	1,645	2,112	2,312	California	22,794	22,085	20,627
				United States	42,443	44,692	45,665

* Data compiled by Dallas W. Smythe, Extension Specialist in Agricultural Economics, from U. S. Department of Agriculture, Bureau of Agricultural Economics, Crop Reporting Board, U. S. General Crop Report: December, 1934. December 18, 1934. Revised in 1935.

varieties. In 1932, about 85 per cent of all the canning-peach varieties north of Tehachapi were 5 years old or older. Of this acreage 44 per cent was planted in 1922, 1923, and 1924. Under California conditions a peach tree has an average commercial life of about 20 years, with the peak of production from 9 to 12 years of age.

For drying, freestone peaches are used almost exclusively, although during the recent overproduction of the canning varieties a few clingstones have been dried. A larger proportion of the freestone trees are past their peak of production than is the case with the canning varieties. In 1929, 64 per cent of all freestone trees were 11 years old or older.

Slightly more than half of the California acreage of freestones is planted to Lovell and Muir. In 1932 a little over 90 per cent of all freestone trees in the state were bearing. Recently there have been no heavy plantings.

The extensive Sacramento and San Joaquin valleys contain a large proportion of all the peach trees in California; large areas in these val-

TABLE 2

ESTIMATED PEACH ACREAGE IN LEADING PEACH-PRODUCING COUNTIES OF CALIFORNIA FOR 1932, AND TOTAL STATE ACREAGE FOR 1932 TO 1934

County	Clingstone		Freestone		Total	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
Contra Costa	159	65	1,299	103	1,458	168
Santa Clara	616	122	1,117	100	1,733	222
Sutter	15,304	476	458	56	15,762	532
Butte	3,182	91	1,580	171	4,762	262
Yuba	3,512	247	36	74	3,548	321
Sacramento	2,071	26	946	36	3,017	62
Solano	31	.....	2,616	619	2,647	619
Tehama	236	.....	1,759	354	1,995	354
Yolo	229	.....	1,107	125	1,336	125
Fresno	1,663	46	11,995	305	13,658	351
Stanislaus	8,450	332	3,355	90	11,805	422
Tulare	5,660	338	2,912	258	8,572	596
Merced	4,138	12	3,396	98	7,534	110
San Joaquin	4,216	60	3,293	213	7,509	273
Kings	647	45	3,630	225	4,277	270
Placer	1,879	42	4,637	686	6,516	728
San Bernardino	4,114	152	2,018	305	6,132	457
Riverside	2,424	25	924	284	3,348	309
Other counties	2,901	505	7,776	841	10,677	960
Total, 1932	61,432	2,584	54,854	4,943	116,286	7,141
Total, 1933	53,500	1,500	53,900	3,800	107,400	5,300
Total, 1934	53,200	1,000	53,700	4,000	106,900	5,000

Source of data: California Coöperative Crop Reporting Service.

leys have soil that is best suited for their growth, and where sufficient water is available, large crops can be produced.

The San Joaquin Valley district has the greatest peach acreage of any district in the state: in 1932, about 43 per cent of the total. The acreage of canning peaches is about equally divided between the two districts, the San Joaquin Valley, however, having a greater acreage of freestone varieties than the Sacramento. Most of the dried peaches of California are produced in the San Joaquin Valley, chiefly in Fresno, Tulare, Merced, Stanislaus, San Joaquin, and Kings counties. Areas around

Atwater, Livingston, Modesto, and certain sections in Fresno and Tulare counties, also grow peaches for shipment as fresh fruit.

In 1932, the Sacramento Valley had about 30 per cent of the total acreage in the state. In this area Sutter, Butte, Sacramento, and Yuba counties grow mostly clingstone varieties for canning. In Solano, Yolo, and Tehama counties the varieties are mostly freestone, much of the crop being shipped fresh.

Placer County, in the Sierra foothills, has considerable acreage of both free and clingstone varieties. As conditions there favor the production of shipping fruit, practically the entire crop is marketed fresh.

In 1932, the southern California district had about 10 per cent of the peach acreage. In this area many varieties of peaches suffer from delayed foliation, and the acreage will probably decline until desirable varieties have been produced that are not affected by warm winters.

Table 2 gives the leading peach-producing counties of the state, the estimated acreage in 1932, and the total state acreage in 1933 and 1934.

CHOOSING A LOCATION FOR PEACHES

Compared with other deciduous fruit trees, the peach is relatively short-lived. It comes into bearing at 3 to 5 years of age, reaches its peak of production at 9 to 12 years, and may decline rather rapidly. The commercial life of a tree is about 20 years. Although many trees produce good crops after this age, orchards 20 years old usually have so many missing and weak trees that they do not produce profitably. Because of the relatively short period of production, an important factor to consider in choosing an orchard site is the initial or developmental costs. The land may produce good peaches, but if the costs are excessive the returns may not pay a fair rate of interest on the investment. In choosing a location for a peach orchard the most important factors to be considered are: (1) climate, (2) water supply, (3) soil, and (4) transportation and marketing facilities.

Climate.—In considering a site suitable for peaches, or in choosing varieties, at least three important climatic conditions should be considered: (1) winter weather having enough days of cold weather to break the rest period sufficiently to prevent injurious delayed foliation, (2) weather conditions during the blooming period, and (3) conditions during the growing season that will produce high-quality fruit.

North of the Tehachapi Mountains the temperature is usually low enough during most winters to break the rest period satisfactorily. In southern California many winters are not cold enough to prevent injurious delayed foliation of most commercial varieties.

In California, weather conditions during the blossoming period and

shortly afterward are very important, for practically all the loss from low temperatures occurs during this period. The location should be reasonably free from spring frosts. Fogs at this time may also hinder pollination and favor the destruction of blossoms from diseases such as brown rot.

Both the fruit and the tree seem to do better when rather high temperatures, abundant sunshine, and low humidities prevail during the growing season. Coast sections, with heavy fogs and cool, damp atmospheres, are not well suited to peach growing; such climatic conditions favor the development of brown rot and other fungus diseases, tend to lessen the color of the fruit, and possibly lower the quality.

Most of the best California peach orchards are located at elevations below 1,500 feet. The principal peach districts in the state are found in the Sacramento and San Joaquin valleys at elevations up to 300 feet. There are a few orchards in the foothill districts, but the elevation of the profitable ones rarely exceeds 2,000 feet. The former areas approach the ideal condition of cool winters, infrequent spring frosts, and warm summers free of fogs and high humidities.

Water Supply.—Peach trees very quickly show distress if available water is lacking. Although they may be grown in California with only the normal rainfall, for profitable production they should be planted only where the annual rainfall can be supplemented with irrigation water.

Soil.—The best soil for the peach is probably one that approaches the ideal fruit soil, being deep, fertile, well drained, easily worked, not too heavy, and free from alkali. Peaches do well on soils more sandy than the ideal, however, if sufficient nitrogen and water are available. Large areas in the state are wholly unsuited to peach growing because of the character of the soil. Before buying land one should also determine the nature of the subsoil.

Excessive irrigation has sometimes resulted in the rise of the water table, causing injury to the orchards. A high water table not only seriously limits the root development of the peach, but may become a factor in the rise and accumulation of alkali in the upper soil layers where most of the roots are found. The water table should preferably not be within 6 or 8 feet of the surface. Drainage to remove excess water may be feasible in some cases, although expensive. Land that requires drainage may be more satisfactorily utilized for the growing of other crops.

Transportation and Marketing Facilities.—Because of their perishable nature, shipping and canning peaches must be handled without delay. Numerous shipping organizations with daily refrigerator service

and good railroad facilities provide all main centers of production with transportation and marketing facilities. Much fruit for local markets and canneries is transported by motor truck, the present highway system having solved the local transportation problem.

VARIETIES OF PEACHES FOR THE ORCHARD

Choice of Varieties.—In choosing varieties of peaches for the orchard there are three important considerations: (1) adaptability to local conditions, (2) suitability for the purpose for which they are grown, and (3) time and sequence of ripening. The value of a variety in a particular locality can be best learned from the experience of local growers.

Groups of Peach Varieties.—Some authorities divide the peaches into five groups: (1) Peen-to or Saucer, (2) Honey, (3) Spanish, (4) Chinese Cling, and (5) Persian.

The varieties in the Peen-to (Saucer) group are flat, usually with juicy, white flesh mottled with red. The pit is small and round without pronounced corrugations. This group is adapted to subtropical conditions, the tree frequently holds its leaves throughout the winter, and is not affected by delayed foliation.

The fruit of the Honey group has a deep suture and a pronounced beak. It has a sweet honey-like flavor, but does not keep well. The tree tends to hold its leaves over winter. The typical varieties are Honey, Florida Gem, and Pallas. These, like the varieties of the Peen-to group, are not troubled by delayed foliation.

The flesh of the Spanish group is in general red and firm, and the skin is noticeably pubescent. The tree is large, vigorous, and adapted to the warmer localities. The red or blood-fleshed peaches have little commercial importance. There are both cling and freestone sorts, rather variable as to redness of flesh. They are usually called Indian Blood peaches. Many persons prefer them for home pickling.

The fruit of the Chinese Cling group is dull colored, with a thin skin and with flesh that is white or yellow, juicy, fine grained, and of good quality. The leaves are large. Most commercial varieties are found in this or in the Persian group. Typical varieties are Chinese Cling, Carman, and Greensboro. The Elberta is probably a cross between Chinese Cling and Early Crawford. These varieties tend to have a long rest period.

The Persian group includes all varieties originating from the importations from Persia by way of Italy and Great Britain. Some typical varieties are Alexander, Early Crawford, Late Crawford, Hale Early, St. John, Susquehanna, Tuscan, Phillips Cling, Heath, Foster, Lemon

Cling, Salwey, and the somewhat newer midsummer varieties Paloro, Hauss, Gaume, Johnson, Halford, Walton, and Sims. Like the Chinese Cling, the varieties of this group also drop their leaves early and have a rather long rest period.

Suitability of the Variety for a Given Purpose.—Since peaches are raised for drying, shipping, canning, or home consumption, one should select the varieties best suited to these special purposes. The condition of the market has much to do with the way the fruit is sold or used and some orchardists prefer to raise freestone varieties that may be either dried or sold fresh. Clingstone peaches are used mostly for canning, although a few are shipped fresh.

Canneries use only yellow-fleshed peaches, preferably clingstones. Their standard calls for a firm peach with a golden color, good symmetrical size, no red at the pit, and a small pit.

Among the yellow clingstone varieties the Tuscan and Phillips Cling were formerly preferred because they interfered less with the canning of pears, plums, and cherries in July and because desirable midsummer peaches were not then available. The midsummer varieties such as the Hauss, Paloro, Peak, Johnson, Gaume, and Sims, however, are increasing in popularity. The Tuscan and Phillips Cling appear to be losing favor because of defects such as split-pit and gumming. The Tuscan is also objectionable because of the red near the pit, which causes a colored syrup and is no longer, in years of full crops, accepted by the canner.

A good drying peach should preferably be a freestone with a small pit. The flesh should be of a clear yellow with no red color at the pit, firm in texture and sweet in taste. A peach like the Muir requires about 5 pounds of fresh fruit to make 1 pound of dried, whereas more juicy varieties such as the Elberta require about 7 pounds. In order of preference, the three leading drying varieties are Lovell, Muir, and Elberta.

Characteristics desired in shipping varieties are good color and size, high flavor and quality, and capacity to withstand shipment without bruising so the fruit will keep well on the market. Most early dessert peaches have white flesh, and many are clingstones. The market prefers a yellow-fleshed freestone peach, relatively free from fuzz. A variety that will meet these demands and also be satisfactory for canning or drying has distinct advantages. The Elberta and the J. H. Hale most nearly fulfill these requirements. Other shipping varieties include Mayflower, Alexander, Triumph, Hale Early, St. John, Early Crawford, Strawberry, Salwey, Foster, and Levi.

Time and Sequence of Ripening.—Because of the short time during which a canning peach is suitable for picking and canning, these varieties must have a proper sequence of maturity in order to be handled

successfully by both grower and canner. With the varieties now planted the season is about 6 weeks long.

For drying varieties less stress is placed on the sequence than on the time of ripening. The variety should ripen so as to be dried before the early fall rains and delivered to the packing-house by the end of October. When the acreage is large and labor scarce, sequence in ripening, however, also becomes important. In such cases it may be advisable to choose

TABLE 3

TIME OF RIPENING OF VARIETIES OF CANNING PEACHES*

1932		1933		1934	
Variety	Date	Variety	Date	Variety	Date
Tuscan	July 21	Tuscan	Aug. 4	Tuscan	July 8
Hauss	Aug. 9	Walton	Aug. 21	Hauss	July 21
Walton	Aug. 9	Hauss	Aug. 22	Walton	July 22
Paloro	Aug. 10	Paloro	Aug. 22	Paloro	July 22
Johnson	Aug. 14	Peak	Aug. 22	Johnson	July 24
Peak	Aug. 15	Johnson	Aug. 26	Peak	July 25
Gaume	Aug. 20	Gaume	Sept. 2	Gaume	Aug. 2
Sims	Aug. 23	Sims	Sept. 2	Libbee	Aug. 2
Halford	Aug. 24	Halford	.....	Sims	Aug. 6
Libbee	Aug. 24	Libbee	.....	Halford	Aug. 10
Phillips Cling	Sept. 2	Phillips Cling	Sept. 12	Phillips Cling	Aug. 16

* Original data furnished by R. H. Klamt from the records of the California Canning Peach Growers.

more than one variety in order to distribute harvesting and drying over a longer period.

In the case of fresh fruit the time of ripening is especially important. The shipping fruit must be on the market when the demand is good. There must be not only a good demand for peaches as compared with other fruits, but a satisfactory demand for the particular variety. New commercial plantings of shipping peaches should not ordinarily include a variety that must compete with a more popular one on the same market, although local preferences and home use may warrant a limited planting of the less popular varieties.

Sequence and Approximate Ripening Dates for Canning Varieties.—The factors governing the time when the fruit is ready to pick are such that no definite ripening date can be set for a variety. The sequence of ripening among them, however, is rather constant when they are grown under similar conditions. The data in table 3 indicate the order of ripening and the amount of time between the harvest dates for the several varieties. The dates are the average of the mid-points of the picking season of three districts in Sutter County. The year 1934 was a very early season; 1933 a late one; 1932 about average. This sequence, the

result of averages for three districts, can easily be changed in the same orchard among such varieties as Hauss, Walton, Paloro, Johnson, and Peak (which normally ripen close together), by such factors as variations in soil, in vigor of the trees, or in amounts of crop.

Approximate Ripening Dates for Shipping and Drying Peaches.— The shipping season extends from late May through September. The

TABLE 4

FLESH COLOR AND ADHESION WITH RIPENING DATES OF PEACH VARIETIES FOR THE HOME ORCHARD

Variety	Flesh color	Flesh adhesion	Date of ripening at Davis
Mayflower	White	Cling	June 1
Alexander	White	Cling	June 3
Briggs	White	Semi-cling	June 15
Admiral Dewey	Yellow	Free	June 25
Triumph	Yellow	Free	June 25
Hale Early	White	Free	June 27
Babcock	White	Free	.....
Rochester	Yellow	Free	July 8
St. John	Yellow	Free	July 8
Ideal	Yellow	Free	July 14
Tuscan*	Yellow	Cling	July 15
Early Crawford	Yellow	Free	July 25
Early Elberta	Yellow	Free	July 25
Elberta	Yellow	Free	July 29
J. H. Hale	Yellow	Free	July 29
Pal ro*	Yellow	Cling	August 1
Late Crawford	Yellow	Free	August 10
Gaume*	Yellow	Cling	August 10
Rio Oso Gem	Yellow	Free	August 10
Lovell	Yellow	Free	August 20
Currie Free	Yellow	Free	August 21
Phillips Cling*	Yellow	Cling	August 25
Heath*	White	Cling	September 1
Salwey	Yellow	Free	September 7
Levi*	Yellow	Cling	September 7

* Canning clingstone varieties.

Elberta is probably the most important shipping variety, though the J. H. Hale is gaining in popularity.

Lovell and Muir are the most important drying varieties, but any of the other yellow-fleshed sorts may be dried.

The principal shipping and drying varieties, in approximate order of ripening, are: Mayflower, Alexander, Red Bird, Triumph, St. John, Early Crawford, Tuscan, Strawberry, Elberta, J. H. Hale, Muir, Late Crawford, Lovell, Salwey, Phillips Cling, and Levi (Henrietta). No ripening date is indicated; for it varies from season to season, from section to section, and according to the destination of the fruit, whether distant or local markets or dry-yard.

Peaches for the Home Orchard.—Table 4 includes peaches desirable for the home orchard. The list includes a number of varieties not recommended for commercial planting but mentioned in the home-orchard list because of their ripening date or quality. No grower, probably, will plant the whole list; each will choose varieties desirable for his location, securing a sequence of ripening to cover the entire peach season. Probably no one would require more than one variety of yellow canning clings in a home orchard, but several are suggested because many persons have variety preference.

The table also includes the flesh color; the flesh adhesion, whether freestone or cling; and the ripening date at Davis, California. This date is for the first few normal fruits that are eating-ripe. The dates will vary from season to season and in different locations, but the sequence will remain approximately the same.

DESCRIPTION OF IMPORTANT VARIETIES OF PEACHES

Alexander.—The Alexander originated in Illinois soon after the Civil War. A parent of several good early-ripening peaches, it is not now grown extensively anywhere except in California. The fruit is greenish white, nearly covered with deep-red color. The flesh is firm, juicy, and sweet; as grown in California it withstands transportation fairly well. The trees appear somewhat more resistant to leaf curl than many other varieties and are hardy and vigorous. The fruit is inclined to be somewhat small, the stone only partly free. The quality for eating is fair. Often the tree is lacking in productiveness, and the fruits are relatively susceptible to brown rot.

Babcock Peach.[8]—The Babcock peach was originated by Professor E. B. Babcock as a second-generation hybrid from a cross between Strawberry and Peen-to. A white-fleshed freestone, it is nearly round and medium-sized; the pubescence is very light. The exposed cheek is deep-purplish red; the flesh is nearly pure white, but red near the pit, very juicy and tender; the quality is good. It is very sweet, has a mild flavor, and is crisp until ripe. The tree is not affected by delayed foliation.

Early Crawford.—The Early Crawford originated in New Jersey in the early part of the Nineteenth Century. The fruit has a very high quality, rich flavor, tender flesh, pleasing aroma, and abundant juice. It is very attractive, being large, with a deep-red color on the sunny side, an excellent freestone variety for the home orchard. The trees are healthy and grow vigorously but are rather late in coming into full bearing. Although once the most extensively planted variety in Cali-

[8] Weldon, Geo. P., and J. W. Lesley. The Babcock peach. California Agr. Exp. Sta. Cir. 328. 1–5. 1933. (Out of print.)

fornia, it is now losing its popularity. In many sections the bearing has proved uncertain.

Elberta.—The Elberta originated in Georgia about 1870 from a seed of the Chinese Cling that had supposedly been pollinated by Early Crawford.

This, the predominating variety of peach in most of the producing centers in the United States, is in demand as a fresh fruit and is perhaps the most popular variety on the principal markets. It is cosmopolitan, succeeding on a variety of soils and under widely different climatic conditions. The fruits are large, attractive, freestone; they ship and keep well. The variety is sometimes used for drying, 6 or 7 pounds of fresh fruit giving 1 pound of dried product. For eating, the fruits are only medium in quality and the stone is somewhat large. Several strains or types of Elbertas have been discovered and are called by such names as June Elberta, Late Elberta, Early Elberta, and Fay Elberta.

Gaume.—The Gaume was discovered by Louis Gaume in 1913. The fruit was first noticed by Mr. Gaume in a lot of Lovell peaches delivered to the cannery from the orchard of J. L. Ames of Live Oak, Sutter County, California. The parent tree was traced out and the first trees were budded in 1914. The flesh is yellow, firm, of desirable texture for canning and free from red color at the pit. It is a good producer, midseason in time of ripening. The fruit withstands handling well but tends to drop prematurely. The variety is somewhat susceptible to peach rust.

Hauss.—This variety was discovered by Fred Hauss in Sutter County in 1900. It was first canned commercially in 1904. The skin is yellow, striped with red. The fruit is round with firm, yellow flesh which is free from red at the pit. It is one of the first midseason peaches to ripen. The trees are productive and vigorous, although the variety is somewhat susceptible to peach rust.

J. H. Hale.—This variety was discovered as a chance seedling by J. H. Hale of South Glastonbury, Connecticut, about 1900. It is a popular, comparatively new shipping variety. The fruit is very large, round, yellow, blushed with red, and freestone. The skin has little fuzz; the flesh is firm and of good quality but red at the pit. Being self-sterile, the variety is unproductive except when properly cross-pollinated. The trees are less vigorous and less widely adaptable than Elberta. Any common variety, apparently, will effectively fertilize the J. H. Hale when their blossom periods overlap.

Halford.—This variety originated in the orchard of J. T. Halford near Hughson, Stanislaus County, California. Three trees in a block of Phillips Cling ripened earlier than the remainder of the orchard. All three trees were different and were first propagated in 1923. They have

been propagated as Halford No. 1, No. 2, and No. 3. The Halford No. 1 has also been propagated as the McKnight Cling. The Halford No. 1 has reniform glands, Halford No. 2 has globose glands, and Halford No. 3 is glandless. The fruits of all three are round and smooth, with yellow flesh throughout. They mature just after the Gaume and before the Phillips Cling. The No. 2 bears more heavily than the other two and for this reason perhaps has been propagated much more extensively than the others. Number 2 seems promising although it has not been planted extensively enough to permit judgment of its value.

Ideal (S.P.I. 43127).—The Ideal was introduced by the United States Department of Agriculture from New Zealand in 1916. The objection has been made that it drops badly before ripening. At Davis it produces a fair yield of medium to above-medium-sized fruit. Its firm, golden-yellow flesh is of good quality and is desirable as a home-orchard fruit. It ripens about 10 days before the Elberta and is being propagated commercially by several nurserymen.

Johnson.—This very vigorous and productive variety was found by Mr. G. S. Johnson in Sutter County, California, about 1911. The fruit is large, with fine-grained flesh that is free from red at the pit. The pit is small. The variety appears to be somewhat less susceptible to rust than some of the other midsummer peaches.

Lovell.—The Lovell originated near Winters, California, and was named about 1882. Outside this state it is not extensively grown. The fruit is uniformly large, nearly spherical, and freestone. The flesh is firm, of a clear yellow color at the pit. It is a good general-purpose peach, fairly satisfactory for canning, and ships well. It is, however, most extensively dried, the drying ratio being about 6 to 1. The tree is vigorous and productive but, as grown in some places, appears susceptible to leaf curl. The color of the skin is not particularly attractive.

Muir.—The Muir originated as a chance seedling about half a century ago on the estate of John Muir in Contra Costa County, California. It resembles the variety known as Wager. Claims are made for several supposed variations of the Muir. It is the standard drying peach in California, being especially adapted to this purpose for the following reasons: sweetness of flavor; density or firmness of flesh; uniformly clear yellow color, free from red about the pit; comparatively low ratio of green weight to dry weight—about 5 to 1. The fruit is large and freestone, with a relatively small pit. The trees are productive, fairly vigorous, and little subject to leaf curl.

Paloro.—The Paloro originated as a chance seedling in a dooryard at Gridley, California, and was later named by Frank A. Dixon. The name is a contraction of two Spanish words: *palo,* meaning tree, and *oro,*

meaning gold. It was first propagated in 1912. The fruit is large, round, and yellow, with a slight blush on the sunny side. The flesh, clear yellow to the pit, is firm enough to withstand handling well. It is an excellent midsummer canning variety, in demand among canners. The tree, though vigorous and productive, is subject to peach blight, peach rust, mildew, and tends to drop the fruit somewhat prematurely.

Peak.—The Peak originated near Selma in the San Joaquin Valley. It is so similar to Paloro that many persons insist the two are identical, although some growers feel that it is more vigorous than the latter variety. The description of the fruit of the Paloro applies equally well to Peak.

Phillips Cling.—This variety originated as a chance seedling in the orchard of Joseph Phillips of Sutter County, California, about 1885. Discovered in a cannery by Mrs. E. Hailstone, it was first propagated by J. T. Bogue of Marysville. This is the most extensively grown yellow clingstone variety in the state. The fruit is large and highly yellow colored, with a firm flesh. It has no red color at the pit, and the stone is small. It ripens progressively, so that picking can be extended without loss caused by dropping from the tree. The fruit is subject to gumming and split-pit, which may result in serious losses.

Red Bird.—The Red Bird is an early, firm, white-fleshed clingstone. Its creamy-white skin, overspread with bright red, is highly perfumed. It ripens with the Alexander and is a good shipping variety.

Rio Oso Gem.—The Rio Oso Gem originated as a chance seedling on the W. F. Yerkes ranch near Rio Oso, Sutter County, California, in 1922. It first fruited in 1926. Though very similar to the J. H. Hale, it ripens about 10 days to two weeks later. The variety carries United States plant patent number 84. It may be secured through commercial nurseries.

Salwey.—The Salwey was originated in England by Colonel Salwey, who raised it about 1844. Being very late in ripening, it is valuable in extending the freestone-peach season. Because of exceptional adaptability to many soils and climates, it is widely grown in England, France, and the United States. The trees are vigorous, hardy, and productive. The fruit, however, is neither attractive enough in appearance nor high enough in quality to be a first-class dessert variety. The flesh becomes dry with overmaturity and is red at the pit.

St. John.—This freestone variety originated in New Orleans over 100 years ago. It ripens fairly early, has good-quality yellow flesh, and is used for shipping or for home use. The trees are hardy and fairly vigorous. The fruits tend to be medium or small. Also in some years a high percentage of fruits may be unmarketable because of doubles and irregular shape.

Tuscan (Tuskena).—This variety, which originated in Mississippi, appeared on the fruit list of the American Pomological Society in 1873. There appear to be several types. The fruit is large, of good quality, with yellow clingstone flesh red at the pit. It has been rather extensively planted in the interior valleys and foothills of California.

This variety is the first of the canning peaches to ripen. It produces many doubles that increase the thinning cost. The fruit ripens rapidly, especially during hot weather; being easily bruised, it does not ship satisfactorily. In some seasons many pits will be split.

PROPAGATION AND CARE OF NURSERY TREES[9]

Fruit growers, as a rule, do not attempt to grow their own nursery trees. To be successful requires much time and care besides skill that is obtained only through propagation experience. Lacking the time or the skill, most fruit growers prefer to buy their trees from a nurseryman. In some cases, however, individuals may wish to grow their own trees.

Seed Handling.—Peach seeds for stock are generally obtained from a dry-yard. In the late fall (November or December) the seeds, mixed with sand or sandy soil, are placed in boxes out of doors and exposed to winter weather. If the winter is dry, the seed boxes should be watered occasionally. In January or February, when the soil can be worked, the seeds are planted 4 to 6 inches apart in rows about 4 feet apart. The nursery should receive good garden care in order to produce vigorous seedlings, which should be suckered several times during the summer in preparation for budding.

Budding.—If the seedlings are well grown they should be at least ¼ inch in diameter by August, when they are ready to bud. About a week before budding, all leaves and twigs should be removed within 4 to 6 inches of the ground. This practice facilitates the insertion of the bud, which should be placed in the stock near the ground level. The common shield or "T" bud is used. Success depends upon getting contact between the growing tissue of the bud and stock, and securely tying the bud in place to exclude air until it has united with the stock. Budding rubber has largely replaced raffia or twine for tying. If one is successful the bud will unite with the stock in about 10 days. The following spring the stock should be cut back to the bud to force all the growth into it and to form the new top of the desired variety. The developing nursery tree should be given good care in order to develop a strong, vigorous tree. At

[9] For detailed description and illustrated methods of budding, grafting, and handling of tree seeds, see: Hansen, C. J., and E. R. Eggers. Propagation of fruit plants. California Agr. Ext. Cir. 96:1–52. 1936.

the end of the second growing season the one-year-old nursery trees on two-year-old root are ready to be dug for orchard planting.

Top-working.—A grower may wish to top-work peaches to more desirable varieties. This procedure is rarely advisable if the trees are over six or eight years old, or are unhealthy. Many growers think it is inadvisable to top-work peaches, because the wounds usually do not heal over satisfactorily.

Grades of Nursery Trees.—Nurseries grade trees according to diameter just above the bud, but list them according to height, as 4–6 feet, 3–4 feet, or 2–3 feet. Trees should be healthy and preferably medium-sized—about ½ inch in diameter—because the medium-sized tree usually makes the best growth in the orchard. Other things being equal, trees purchased at a nearby nursery are best. They have less chance to dry out, and additional freight rates are avoided.

Care of Nursery Trees.—Nursery trees should be ordered early to insure selection of the desired variety and grade. On delivery, if it is impossible to plant them at once, they should be unpacked and "heeled-in" in well-drained soil. Heeling-in is done by placing the trees in a trench side by side at about the same depth as they grew in the nursery. Loose, moist soil should be sifted around the roots, and the trench filled up, care being taken to pack the soil firmly about the roots. If the soil is dry, it should be soaked down after the trees are heeled-in. Trees may be held in this way from several days to six weeks or more.

ROOTSTOCKS FOR PEACHES

Like all other fruits that do not reproduce true from seed, the desired varieties of peach must be budded onto seedling stocks. Probably 96 to 98 per cent of the trees are on seedling peach root. The seeds are usually collected from dry-yards but occasionally from canneries. Where the nematode is prevalent the common peach seedling is unsatisfactory, being subject to attack. In an attempt to escape nematode damage, apricot root has been used; but although a few such orchards do fairly well, apricot stock cannot be recommended as satisfactory. Myrobalan plum, though sometimes used, does not make a satisfactory union with peach and in general cannot be recommended.

Because of the nematode injury in certain areas, the Division of Pomology of the University of California has tested a great number of peach seedlings for resistance. It was found that several varieties introduced by the United States Department of Agriculture are highly resistant if not immune to nematode. One of these (Shalil) was introduced from India; another from Yunnan, China. Seedlings of Bokhara, a variety introduced from Russia, also show high resistance to nematode.

To date the investigation on the nematode problem is still experimental, so that several years' additional observations must be made. Judging from the present observations, peach seedlings may yet be obtained that are immune or at least highly resistant to nematode injury and likely to be a more satisfactory stock than the apricot.

The almond stock, though used, is not satisfactory under most conditions and cannot be generally recommended.

Seedlings of *Prunus davidiana,* which are resistant to larger amounts of alkali than the peach, have not proved very satisfactory, probably because of susceptibility to crown gall.

ESTABLISHING THE ORCHARD

The successive steps in establishing the commercial peach orchard include grading the land, installing the irrigation system, laying out or locating the tree positions, planting, and caring for the young trees.

Grading the Land.—The proper preparation of land before planting is highly important. In some cases sites selected are fairly uniform as to slope and require very little grading. Usually, however, the land must be leveled to conform to the irrigation system and facilitate the distribution of water. It should not be scraped so deep as to result in infertile spots, which prevent the normal growth of the trees.

Installing the Irrigation System.[10]—In practically all areas in California, irrigation is required for successful peach culture. The irrigation system, therefore, should be installed before planting. It is possible to tank the trees the first year in the orchard and postpone the pump installation.[11]

Laying Out the Orchard.—Most California orchards are planted by the square system, in which the trees and rows are the same distance apart and at right angles to each other. Peach trees are planted 18 to 24 or more feet apart.[12] In determining the most desirable planting distance, one must consider many factors. If trees are planted too close together under conditions where vigorous growth occurs, undue crowding will take place. If, on the other hand, the trees are too far apart, maximum crops per acre cannot be secured. Where tree growth is very good, furthermore, the trees become too tall for economical handling, which cuts down the net returns. Many orchards in the state, planted 20 to 22

[10] Huberty, M. R., and J. B. Brown. Irrigation of orchards by contour furrows. California Agr. Ext. Cir. 16:1–16. Revised 1932.

[11] Johnston, C. N. Principles governing the choice, operation and care of small irrigation pumping plants. California Agr. Exp. Sta. Cir. 312:1–28. 1928. (Out of print.)

[12] Allen, F. W. Planting and thinning distances for deciduous fruit trees. California Agr. Exp. Sta. Bul. 414:1–29. 1926. (Out of print.)

feet apart, produce 15 to 20 tons an acre. For usual conditions, at least, 20–22 feet appears to be the most economical planting distance.

There are numerous ways of laying out the orchard (locating the tree positions).[13] Any method that places the trees in straight rows economically is satisfactory.

Planting.—The earlier in the winter trees can be planted the better. It is impossible, however, to get trees from the nursery much before January. Planting may be done as late as March. Early planting is to be preferred unless soils or weather conditions are unfavorable.

When planting, if the ground has been properly prepared, the holes need not be larger than is necessary in order to accommodate the roots in their natural position. Unduly long roots may be shortened, and damaged roots removed. The soil should be well firmed around the roots. This may be done by tamping the soil or by running water around the trees as soon as they are planted. The trees should be planted at the same depth they grew in the nursery. They should previously be examined to make sure they are not diseased or infested with root insects.

After planting, many protect the trees from sunburn by means of tree protectors or whitewashing; this is advisable particularly if the orchard is planted under unfavorable conditions. If, however, the trees are planted properly and early, under good growing conditions, sunburn is seldom a problem with peaches.

A good whitewash may be made as follows: quicklime 5 pounds, salt ½ pound, sulfur ¼ pound. Add the salt and sulfur while the lime is slaking. Allow the whitewash to age several days before using. Dilute to a buttermilk consistency so that it is easily applied with a brush. Another good formula is: whiting 6 pounds, casein spreader 1 pound, raw linseed oil ⅓ pint. This sticks better than the lime whitewash but is more expensive.

Tree protectors will prevent sunburn if properly put on and if not removed or broken off during the summer. They should be forced down into the soil so that during subsequent working around the trees they will not slip lower, exposing trunk bark near the top of the protector. The bark has become tender because of the protector; and if suddenly exposed during the summer it will sunburn readily. Another objection to tree protectors is that most people use those which come up almost to the top of the tree. These force all lateral growth from around the top of the trunk and make it impossible to select framework branches well distributed up and down the trunk.

Care of the Young Trees.—After the orchard is set out, the trees

[13] Wickson, E. J. The California fruits and how to grow them. 10th ed. p. 85–92. Publ. by Pacific Rural Press, San Francisco. 1926.

should be kept growing vigorously. Normally, clean culture should be practiced; and irrigations should be sufficiently frequent so that the trees do not suffer from lack of moisture.

Sometimes the orchardist wishes to grow intercrops in the young, developing peach orchard. Given good soil and plenty of water, there is no objection to the practice provided the grower remembers that the peaches are his main crop and does not grow the intercrops at the expense of the trees.

The grower should control all insect and disease pests that interfere with the normal growth of the trees. The pests likely to require treatment ment will be discussed in another part of this circular.

It is doubtful whether the addition of artificial fertilizers to a young peach orchard is desirable or necessary, provided that a good orchard soil has been selected for the trees.

TRAINING AND PRUNING PEACH TREES

As outlined by Tufts,[14] the purposes of pruning are fivefold:

1. To produce a vigorous, mechanically strong, healthy tree, free from sunburn and capable of producing heavy crops over a long period of years.
2. To secure a tree well shaped for convenience and economy in orchard management.
3. To distribute the fruiting area well over the tree.
4. To insure a succession of profitable crops.
5. To secure size and quality of fruit.

Training and pruning begin as soon as the nursery tree is planted in the orchard. At the time of planting the tree must be cut back or headed to reduce the top, in order to balance the loss of roots removed in digging from the nursery and also to form the head at a desirable height. Generally the tree should be headed at 24 to 30 inches from the ground, and the laterals all removed. In removing the laterals one should leave short stubs so as not to injure the ring of tissue surrounding the twig at its junction with the trunk. From this tissue the "blind eyes" give rise to new shoots. Occasionally nursery laterals can be saved to form the main framework branches. When stocky laterals, usually three in number, are placed equally around the trunk, preferably 6 to 8 inches apart, they should be saved for framework and headed moderately. All remaining laterals should be cut to stubs. In heading laterals for framework branches, whether at the time of planting or later, one should leave the topmost lateral a little longer than the other two so that the topmost

[14] Tufts, Warren P. Pruning young deciduous fruit trees. California Agr. Exp. Sta. Bul. 313:1–43. Revised 1927. (Out of print.)

Fig. 3.—Note the choking out of the central or topmost branch by the more vigorous growth of the lower branches.

branch will not be choked out (fig. 3) by the more vigorous growth of the lower branches.

Much can be accomplished in training young trees by early summer pinching, especially during the first and second summers. A tree on which, at the time of planting, all laterals were cut back to stubs will

Fig. 4.—One-year-old peach tree before and after pruning.

send out many shoots. If one will take the time to go over the trees in early summer (May to early June), selection of the framework branches can be made. The undesirable growth should be subdued by pinching out the terminal. This procedure will benefit the remaining branches that are used for framework.

First Dormant Pruning.—If no summer pinching has been given, the first dormant pruning will consist of selecting the framework branches, as previously outlined, and heading them moderately (15 to 30 inches), preferably to laterals (fig. 4). All other vigorous growth should be removed entirely. A few small twigs should be left around the trunk for shade. If the tree was summer-pinched, the framework branches should be headed, and all other undesirable growth removed.

Second Dormant Pruning.—Pruning after two years' growth in the orchard should consist in selecting the secondary framework branches—five to seven, about shoulder high, an average of two from each primary branch. All other vigorous growth should be removed entirely. One should thin the secondary branches and cut to laterals, being careful not to subdue them equally nor to form narrow-angled weak crotches where they join the primary branch (fig. 5).

Fig. 5.—Two-year-old peach tree before and after pruning.

Third and Subsequent Prunings of Young Trees.—These prunings will consist mainly in thinning out the tree, removing cross and interfering branches and water-sprouts. Keep the center of the tree moderately open. Retain enough side branches to shade the main branches and to bear fruit. Trees pruned as outlined above should soon begin to bear fruit and can be handled as bearing trees. The pruning treatment suggested presupposes trees growing under favorable conditions and well cared for.

Fruiting Habit of the Peach.—The fruit buds of the peach are for the most part borne laterally upon one-year shoots; a few laterally on short spur-like twigs. If the tree is making vigorous growth, two fruit buds with a leaf bud between, at the node, frequently occur (fig. 6), whereas with trees making poor growth, fruit buds are generally single. Their distribution upon the twig depends upon the growth of the tree and the habit of the particular variety.

Pruning Bearing Trees.[15]—No fruit tree responds more satisfactorily to proper pruning than the peach nor declines so rapidly with neglect. The principal reason is that the peach produces nearly all its fruit on one-year shoots.

When trees have come into bearing, a mechanically strong, and well-

Fig. 6.—Fruit bud of the peach. Note the two lateral fruit buds with a small leaf bud between. (From Bul. 386.)

formed tree should already have been secured; the aim of the pruner should be to regulate the crop and its distribution, maintaining a balance between fruiting and vegetative growth. Normally a tree under ten years of age should make 20 to 40 inches of new growth each season, and older trees 12 to 30 inches.

[15] Tufts, Warren P. Pruning bearing deciduous fruit trees. California Agr. Exp. Sta. Bul. 386:1–47. 1925. (Out of print.)

In the pruning, one should thin out the larger branches (½ to ¾ inch in diameter), including cross and interfering branches and also weak, decadent branches. In addition, some of the one-year fruiting shoots will have to be removed entirely, the number depending upon the general condition of the tree, the amount of growth, the number and condition of the fruit buds, and, to some extent, the variety.

The development of "hangers"—willowy, drooping branches from the lower framework—should be encouraged. In general, they should receive little or no pruning unless they interfere with cultivation. These hangers make up the skirt, which produce fruit that is thinned and picked most economically.

In pruning the tops, cut back to strong laterals at the desired height. In cutting to laterals, cut to the stocky, brownish laterals rather than the slender, reddish shoots, for the former are better adapted to continue the framework of the tree. With normally vigorous trees it is seldom, if ever, advisable to head either the main laterals or the fruiting shoots. With most varieties, under favorable conditions, thinning out and cutting to laterals is the practice recommended. Peach growers generally limit the height of their trees so that all operations can be accomplished from a 10-foot ladder. Under most conditions it is too expensive to thin and harvest fruit produced above this height.

In cutting to laterals, leave a short stub, ¼ to ½ inch long. This prevents any injury to the lateral in pruning and eliminates the danger of breakage—an important consideration, especially in young bearing trees where the continuation of the framework is desired.

Sometimes, especially when the desirable amount of length growth is not secured, the shoots should be headed. Besides removing more fruiting wood, this procedure stimulates length growth.

Treatment of Pruning Wounds.—Normally wounds that will not heal over in one or two seasons should be protected; otherwise, the wound will dry out and check, and wood rot will become established. Very often the productive life of the tree is materially shortened by breakage of decayed framework branches.

There are on the market many commercial compounds for covering pruning wounds. Most of these are asphaltum compounds or emulsions that may be applied cold. Bordeaux paste or paint is also used. Besides covering the wound it has a disinfectant value. Bordeaux should not be applied until after the callus has started to form around the edges of the wound.

Wounds heal over better if the cuts are made close to the parent branch and parallel to it. Stubs, if left, will not heal over and will die back to the parent branch.

CARE OF THE PEACH ORCHARD

Cultivation.—The usual reasons for cultivation are as follows:[16] to remove noxious weeds and weed competition; to facilitate subsequent orchard operation, such as irrigation, harvesting, brush removal, and spraying; to incorporate covercrops and manures; to prepare the soil as a seed bed for covercrops; to facilitate the control of certain pests; and to aid in the absorption of water where tillage or other orchard operations have produced an impervious condition of the soil.

The covercrop, either volunteer or planted, which has grown during the winter should be turned under in the spring. If possible the cultivation should not be delayed until the covercrop has become too bulky to turn under easily or too well matured to decompose readily. It is not desirable, however, to cultivate when the soil is wet. Delaying the cultivation until the upper layers of soil have dried out somewhat will minimize the danger of compacting the soil or of causing a plowsole to form. Cultivation in the spring should be done thoroughly to incorporate the covercrop into the soil. The frequency of cultivation throughout the summer very largely depends upon the available water supply and certain of the orchard operations. The second cultivation will usually not be necessary until after the first irrigation. If the weeds are numerous or large or if the soil has become too compact for furrows or levees to be constructed, it may be necessary to cultivate before the first irrigation. Where water is plentiful and the soil does not crack so badly as to render the levees useless, many growers use the same levees for more than one irrigation. If the soil cracks on drying it will be necessary to cultivate the levees before reconstructing them.

Although some growers do not cultivate the orchard before thinning and picking their fruit, it would seem to be a desirable practice to smooth the soil, especially before picking. Carrying a ladder and picking equipment over levees and through weeds is very exhausting and will rapidly reduce the workman's efficiency. Such a program may be more expensive than a cultivation given the orchard before harvest.

Intercrops.—The growing of an intercrop in a young orchard as a source of income is a frequent practice. The choice of crop used probably makes little difference if the grower remembers that his primary interest is the best development of the young trees. The chief reason for planting an orchard is usually that it will yield greater returns than some other

[16] Veihmeyer, F. J., and A. H. Hendrickson. Essentials of irrigation and cultivation of orchards. California Agr. Ext. Cir. 50:1–24. Revised 1932. (Out of print; reprint in press.)

crop. The sooner the trees reach full bearing, the sooner will the greatest returns be achieved. The intercrop should therefore hinder as little as possible the most rapid development of the young trees.

Covercrops.—During the fall or winter the growing of some covercrop, to be incorporated in the soil early in the spring, is a common practice in most peach orchards. The covercrop may be a volunteer crop of winter-growing weeds, or one that has been planted. If manure has been applied to the orchard, the volunteer crop will usually be heavy. When the covercrop is planted, the plant chosen should be one that will give a desirable amount of green manure to incorporate in the soil in the spring. The growth of the various plants used for covercrops depends upon such environmental factors as soil, water supply, and temperature during the growing season. Thus certain covercrops that need warm weather to get a good start in the fall after planting do very well in the southern part of the San Joaquin Valley, where the temperatures are higher during this period; but these same crops would fail in areas where the fall months are cooler. The grower should choose a crop that he knows will produce an abundant growth during the fall and winter after planting. Among the common leguminous plants used for winter covercrops are sour clover (*Melilotus indica*), common vetch (*Vicia sativa*), and purple vetch (*Vicia atropurpurea*). The mustards and the cereals—rye, barley, and oats—are the nonleguminous plants most commonly used. They are generally planted in the fall, from the middle of September to the middle of October, in order to be established before cold weather. Additional water may be needed in order to induce germination.

Commercial Fertilizers.—The only commercial fertilizer to which the peach tree appears to respond directly is nitrogen. The peach is more sensitive to a nitrogen deficiency than most other deciduous fruits and responds to this element when the apple and pear do not. Peach trees without an adequate supply of nitrogen have small, pale-green to yellow leaves and a short, spindly annual growth. Trees showing this type of growth may be suspected of lacking nitrogen, although other conditions may produce similar symptoms. If trees with these symptoms do have a shortage of nitrogen they will respond to its application by producing larger, greener leaves and longer, stockier shoot growth. Trees responding to this fertilizer will nearly always have the maturity of their fruit delayed a few days and in many cases will produce fruit of less color than if they had shown no response. So far as the response of the tree is concerned, several kinds of nitrogenous fertilizers are satisfactory—for example, ammonium sulfate, sodium nitrate, calcium nitrate, and urea. The fertilizer should be purchased on the basis of the cost per unit of

nitrogen. Ammonium sulfate, a common fertilizer, is usually applied in the late winter or early spring at the rate of ½ pound per tree for young orchards, up to as much as 4 or 5 pounds per tree for mature orchards. Other nitrogen-carrying fertilizers should be used in proportionate amounts, according to their nitrogen content.

Frost Protection.[17]—Practically the only injury the peach suffers from low temperatures in California is that from spring frosts. As the flower buds open, they become progressively more susceptible to low temperature. The blossoms are more tender the longer they have been open; and the young fruits are more tender than the newly opened flowers. The young fruits become increasingly subject to frost damage until they are about ½ inch in diameter. It is usually the seed that is killed, the other part of the fruit being unharmed unless the temperature goes lower. In most cases, however, death of the seed will cause the fruit to fall.

The blossoms and young fruit can be protected against frost by means of orchard heating. The question of when or under what conditions the grower should install heating equipment, however, is extremely difficult if not impossible to answer satisfactorily. He must decide whether the increased returns brought by saving the crop over a period of years will more than offset the cost of the heating. In evaluating this question for peaches, one should consider the following factors: (1) The frequency of occurrence of frosts that will destroy or markedly decrease the crop. (2) The effect on the total production that a local frost might have. For example, under the present condition of widespread planting and plentiful production of canning peaches, a reduction of the crop might have to be rather general before any appreciable rise in price would occur. (3) The length of time over which an orchard could produce highly profitable tonnages. This might be especially important in a relatively short-lived tree like the peach. (4) The actual cost of heating in relation to the average increased returns during the profitable life of the orchard.

For deciduous fruits the cost of heating is considerable: for example, if 100 "lard-pail" type heaters and 600 gallons of oil are used per acre, with storage tank, wagon tank, buckets, thermometers, and lighting equipment to accommodate the acreage to be heated, the initial cost has been calculated to be about $100 per acre. On this basis, the annual overhead costs would be about $14 per acre. Some growers have used fewer heaters of larger capacity and have claimed thereby to have reduced the initial cost.

Fruit Thinning.—Because of the heavy set of peaches that ordinarily occurs in California, thinning is a necessary orchard operation. It in-

[17] Schoonover, Warren R., Robert W. Hodgson, and Floyd D. Young. Frost protection in California orchards. California Agr. Ext. Cir. 40:1–73. 1930.

creases the size and tonnage of salable fruit and decreases breakage of branches.

Growers disagree somewhat as to the proper time for thinning. Probably the best criterion for different varieties is the length of the period that will elapse between thinning and maturity. This generalization will be modified by the amount of bloom and original crop that is on the tree. A tree with a very heavy crop should be thinned earlier and more heavily than one with an average or medium crop, whereas a tree with a light crop can be thinned later and less heavily than a tree with a medium-sized crop. According to some preliminary investigations, thinning may be done later than was formerly thought. Many varieties of peaches, except possibly the very early-maturing ones, can probably be thinned as late as 8 to 10 weeks before maturity. The rate at which the fruit has grown in the period before the approximate time to thin will help determine when thinning should be done. Certain advantages are obtained if thinning can be delayed: (1) the difference in size among the fruits becomes more pronounced, permitting a better selection of the larger ones and the removal of the smaller; (2) a better idea of the sizing ability of the tree and a more uniform and accurate distribution of the fruit may be had; (3) a larger proportion of the cull fruit may be removed; and (4) the labor of removing the fruits is less, so that more trees can be thinned per day.

The number of fruits to leave on the tree and the distance between them are determined by the ability of the tree to size the fruit and by the ultimate size desired. The ability to size depends upon the crop that the tree is carrying at thinning time, upon the vigor of the tree, and upon the water available throughout the growing season. The desired size of the fruit is also of importance in deciding upon the manner of thinning. The more fruits left on the tree, the greater the total tonnage. But to produce a fruit above the minimum size, one may have to reduce the total tonnage in order to increase the salable tonnage. Fruit to be picked for shipping before it has reached its full size must be thinned more heavily than fruit that will reach full size on the tree.

The fruit of a normally bearing peach tree will be borne on shoots 6 to 18 inches long. Usually a satisfactory distribution of fruit can be had by leaving one to three fruits per shoot, according to its length. Where a long shoot growth has been made, as in young trees or in the tops of vigorous old ones, the fruits can be spaced 4 to 6 inches apart, according to number and length of such shoots. Fruit on hanger branches around the lower part of the tree should be thinned more heavily than in the upper part of the tree since these lower hanger branches are in a less favorable growing position.

In any locality the experience of the grower is the best standard as to the ability of the trees to size the fruit. He usually has a fairly accurate idea of what tonnage his orchard should produce. He should thin his trees to bear this amount—that is, leave an average number of fruits on the tree so that this tonnage will be secured. Table 5 gives the average number of peaches of different sizes required to give the desired production per tree.[18] These figures are for the number of peaches of a

TABLE 5

CALCULATED NUMBER PER TREE OF PEACHES OF VARIOUS SIZES TO PRODUCE GIVEN TONNAGES PER ACRE WITH TREES AT VARIOUS PLANTING DISTANCES*

Tons	20×20 feet (108 trees per acre)				22×22 feet (90 trees per acre)				24×24 feet (75 trees per acre)			
	2⅜ inches	2½ inches	2¾ inches	3 inches	2⅜ inches	2½ inches	2¾ inches	3 inches	2⅜ inches	2½ inches	2¾ inches	3 inches
1.....	83	70	54	40	100	84	64	49	120	101	77	58
5.....	415	350	270	200	500	420	320	245	600	505	375	240
10.....	830	700	540	400	1,000	840	640	490	1,200	1,010	770	580
15.....	1,245	1,050	810	600	1,500	1,260	960	735	1,800	1,515	1,155	870

* The calculations in this table have been made from the number of peaches of various sizes in 10 pounds of fruit, as follows:—2 inches, 76; 2¼ inches, 53; 2⅜ inches, 45; 2½ inches, 38; 2¾ inches, 29; 3 inches, 22.

given size in a ton, and do not represent the number of fruits to be left on the tree when thinning to produce the desired tonnage of a given size. Since there are always some fruits which never attain a marketable size, more peaches than the indicated number must be left. It is here that the experience of the grower regarding the ability of his trees to size the fruit is of importance.

Bracing.—Practically all mature peach trees need some type of bracing. Various systems are in use. One type of permanent system employs wires running from screw eyes or stirrups on the branches to a ring in the center of the tree. Once this type of bracing is installed, it requires very little attention. One should inspect the trees in order to repair broken wires, take up unnecessary slack, and change the stirrups to prevent girdling of the branches. The initial cost[19] of a system of wire bracing on eight-year-old peach trees, using screw eyes, has been estimated at 49 cents a tree. This was based on an estimate of 1½ hours of labor at 25 cents an hour per tree.

Bracing with wooden props is used by many growers, but these props may hinder cultivation and irrigation near harvest time.

[18] Weldon, George P. A new idea in peach thinning. Chaffey Junior College, Dept. Agr. Bul. 5:1–4. No date.

[19] Adams, R. L., and L. A. Crawford. Farm management crop manual. 200 p. University of California Students' Store, Berkeley. 1933. (Mimeo.)

Irrigation.—Peach trees should have readily available water throughout the growing season. Otherwise they will quickly show an adverse response in decreased tree and fruit growth. Fruit that has fallen behind in its size because of insufficient moisture during the growing season will never regain the size obtained on other trees that were not allowed to suffer for lack of available moisture.[20]

The trees should be irrigated just before the soil becomes dry—that is, before the permanent wilting percentage has been reached. At each irrigation sufficient water should be given to restore the upper 5 or 6 feet of soil to its field capacity. If the winter rains have not been sufficient to wet the upper 5 or 6 feet, one may add a spring irrigation so that the trees will start the season with available water in the whole of the root zone. For mature trees the length of time between irrigations varies from about 3 weeks on the sandy soils to about 6 weeks on the loam soils. It is desirable for the trees always to have available water. Excessive use of irrigation water should be avoided. Judicious application is an important means of checking the rise of ground water and the consequent damage to the trees.

PARASITIC DISEASES AND THEIR CONTROL[21]

The common peach diseases of California fall in two classes: parasitic—or those caused by very small living organisms such as bacteria and fungi, and nonparasitic—those caused by something other than these organisms.

Methods of combating parasitic peach diseases may be classified as follows: (1) planting in localities where the disease is not serious, (2) planting varieties resistant or immune to the disease, (3) planting healthy trees, (4) removing and destroying diseased parts of trees, and (5) preventing infection by means of sprays or dusts. The first method has limited application, since the diseases are not ordinarily restricted in their occurrences, although there are some localities where powdery mildew, for example, is not so serious as in others. Avoiding soil areas known to be infected by the oak-root fungus is another example of the first method. The second method may be used to advantage in certain cases, although when the disease is controllable by sprays it is often more desirable to grow a valuable variety, even if susceptible, and rely upon

[20] Hendrickson, A. H., and F. J. Veihmeyer. Irrigation experiment with peaches in California. California Agr. Exp. Sta. Bul. 479:1–56. 1929.

Further information on irrigation is given in: Veihmeyer, F. J., and A. H. Hendrickson. Essentials of irrigation and cultivation of orchards. California Agr. Ext. Cir. 50:1–24. Revised 1932. (Out of print; reprint in press.)

[21] This section was prepared by E. E. Wilson, Assistant Plant Pathologist in the Experiment Station.

sprays to prevent infection. The third method is important in that certain root diseases, such as crown gall and oak root fungus, may be introduced into disease-free soil by planting diseased nursery stock. The

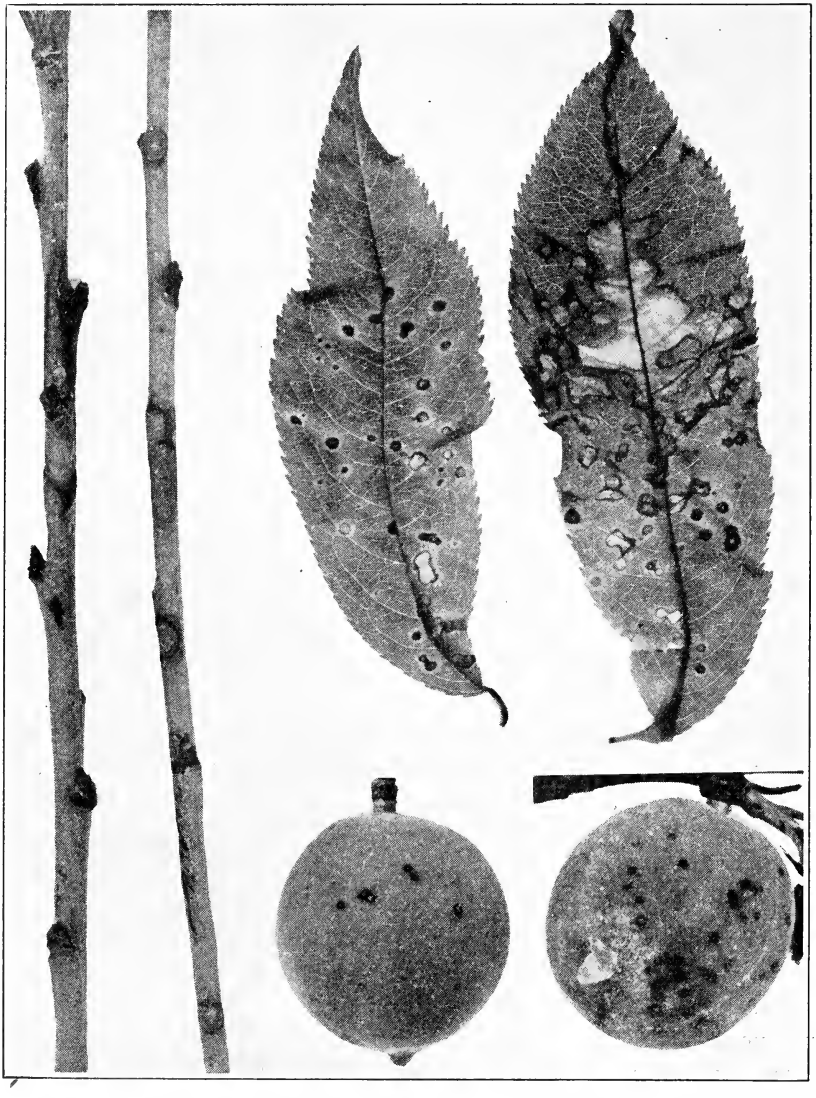

Fig. 7.—Peach blight; typical circular lesions on twigs, leaves, and fruit.

fourth method is of value where followed consistently, inasmuch as many of the diseases persist from one season to the next in infected branches or fruit, and by destroying these parts the amount of new infection is reduced. The fifth method—prevention of infection by sprays or dust—is the most effective means of combating certain diseases. Since,

however, sprays and dusts prevent the disease by destroying the fungus before it enters the tree, they are of little value as curatives. Neither can they be expected to control diseases attacking parts of the tree which cannot be covered with the spray.

Peach Blight.—The fungus *Coryneum beijerinckii* Oud. (fig. 7) is the cause of peach blight. The disease appears first in early spring as circular, small, reddish spots on twigs. Later these spots develop into elongated, sunken, brown cankers which kill the fruiting wood. When leaves appear they may be attacked; and, in years when rains occur

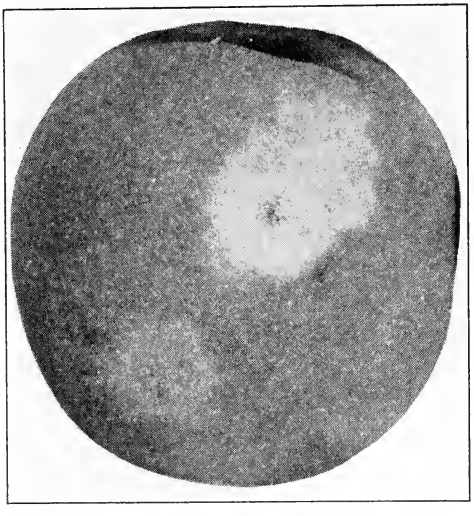

Fig. 8.—Powdery mildew on peach fruit.

late in spring, fruit is also affected. In cases of severe leaf infection the trees are defoliated and are thereby weakened.

Since twig cankers not only kill the fruiting wood but furnish spores for leaf and fruit infection, it is important that they be controlled. This is done by spraying the trees in the fall with bordeaux mixture 5–5–50. Although the spraying is commonly done some time between November 15 and December 15, there is danger in delaying the operation. In 1934–35, for example, rains falling in late November and early December caused infection, so that sprays applied in December were less effective than those applied in mid-November. The trees should therefore be sprayed before the beginning of the rainy season. Though a better coverage is obtained by spraying the trees after the leaves are off, if leaf fall is delayed until there is danger of rain, it would not be advisable to postpone the spray.

The spray program should be supplemented by a consistent removal of diseased twigs each year. There was evidence the past season that in

certain cases the poor control of leaf infection obtained from sprays was not due so much to untimely application as to the presence of numerous cankers from the year before.

Powdery Mildew.—The disease known as powdery mildew is caused by the fungus *Sphaerotheca pannosa* (Wallr.) Lev. (fig. 8). It appears first in early summer as white, powdery blotches on leaves, fruit, and green shoots. Later the fruit lesions turn brown, and the affected tissue becomes roughened and corky so that the fruit is malformed.

Sulfur fungicides are used in controlling powdery mildew, bordeaux mixture being ineffective. Since commercial lime-sulfur can be used only in dilute solution, because of its injury to peach foliage, various sulfur dusts and wettable sulfur sprays have been employed. Wettable sulfur, which has proved to be an efficient fungicide in other states, will probably be found useful for mildew control. A combination used to some extent in California consists in adding 5 pounds of wettable sulfur to a solution containing 1 gallon of liquid lime-sulfur to 100 gallons of water.

The time of applying the fungicide for mildew control is important inasmuch as once the disease gets started control is more difficult. Where control is necessary, the first application of fungicide should therefore be made as soon as the fruit is set and starts growth. For this purpose the combined lime-sulfur and wettable sulfur spray may be used. Later applications of sulfur dust or wettable sulfur spray should be made at 10 to 14-day intervals until the beginning of hot, dry weather.

Brown Rot.—Brown rot is caused by the fungus *Sclerotinia fructiola* (Wint.) Rehm (fig. 9). The first sign of the disease in the spring is the withered, brown blossoms covered by grayish, powdery spore masses. Although blossom blight may not always cause serious loss, it is important in that it builds up the disease to such an extent that spores are constantly being spread throughout the tree during the summer. As the fruit ripens it becomes susceptible to attack and may develop a brown, medium-soft rot either before or after harvest. When the disease attacks fruit on the tree, extensive killing of the smaller branches may occur because, after entering the fruit, the fungus extends into the branches and girdles them. Some twig-killing occurs as a result of the fungus growing from blighted blossoms into the twig, although this was not common during the serious outbreak in 1935.

Orchard sanitation is particularly important in controlling this disease. Figure 9 shows two diseased fruits which remained on the tree until the following spring, producing numerous spores over their surfaces. The ends of the blossoms are projecting from the bud scales and are therefore liable to infection should a rain occur. Hence, it is important that such diseased fruit be removed from the trees and destroyed

before the blossoms appear. In addition, all blighted branches should be removed. This can be done most effectively after the fruit is harvested but before the leaves fall.

Protection of blossoms is afforded by applying bordeaux mixture 8–8–50 when the ends of the blossoms are projecting from the bud scales

Fig. 9.—Brown rot on peach fruit. The fruits were infected the previous year and, having remained on the tree until the buds started growth, produced numerous spores.

(pink bud). This would be a somewhat later stage than that of the most advanced buds represented in figure 9. Where lime-sulfur (8 gallons with water to make 100 gallons of spray) is used for peach-twig-borer control, the pink-bud bordeaux spray should be omitted. Since certain weather conditions favor the development of twig injury by lime-sulfur,

this material should be applied only after consultation with the local agricultural authorities. It can be seen that a spray at the pink-bud stage covers only the ends of the blossoms, unprotected parts becoming exposed as the buds open further. In years when frequent rains occur during this period, control will obviously be more difficult than in years when rainfall is less frequent. Experience has shown, however, that a spray applied at the pink-bud stage gives the best results in most years.

In certain orchards during the 1935 season the disease did not occur to any great extent on the blossoms; yet it appeared and increased rapidly when the fruit began to ripen. This fact shows that fruit rot may be independent of blossom infection and its control may not, therefore, be secured by sprays applied to blossoms but must be accomplished by protecting the fruit. This is difficult because bordeaux mixture leaves a residue on the fruit, and lime-sulfur (except in dilute solution) cannot be used on account of injury to foliage. Sulfur dust, applied at different times during the summer up to within 2 to 4 weeks of harvest, has been reported as satisfactory in other states. Results from sulfur dusts, however, were not altogether satisfactory in this state during 1935—whether because applications were started after fruit rotting had appeared, or because not enough applications were made, could not be determined.

In view of insufficient information regarding the number of applications necessary and the proper timing of them under our conditions, a dust program which has proved satisfactory cannot be presented. The following suggestions for fruit-rot control are based on results obtained in other states: If rains continue after the fruit is set, apply a fungicide. Repeat at the time the fruit begins to ripen (2 to 3 weeks before harvest). Since dusts do not appear to be satisfactory, wettable sulfur sprays may be used. The wettable sulfur leaves a residue and is therefore not well adapted to spraying near harvest time in the case of fresh fruit for shipment. Three pounds of the dry or 5 pounds of the paste type to 100 gallons of water is generally recommended. Maintain a good pressure on the spray pump, and cover the trees thoroughly with a fine mist.

A careful pruning out of blighted branches and removal of mummied fruit should supplement the spray program. This can best be done after harvest but before leaf fall.

Peach Leaf Curl.—The disease known as peach leaf curl is caused by the fungus *Taphrina deformans* (Fel.) Tul. (fig. 10). The disease appears in the spring as red, crinkled, thickened distortions on the leaves and green shoots. A white, mealy bloom occurring on affected parts is the spores of the fungus. Later the fruit may develop red, warty protuberances which render it unsalable.

Control consists in covering the trees thoroughly with bordeaux mix-

ture 5–5–50 before the fruit buds begin to swell in the spring. In California, many growers spray in late autumn for control of this disease as well as peach blight. Though good control of leaf curl has been reported from sprays applied in late fall or winter, there is some evidence that the spring application is more effective. The disadvantages of wait-

Fig. 10.—Crinkled and thickened distortions produced on peach leaves by the leaf-curl fungus.

ing until spring to apply the spray are: it is too late to control peach blight, so that a fall application is also necessary, and spraying operations may be delayed by rain or by wet ground until after the buds swell, when it is too late for control of leaf curl. The advantages are, therefore, with late fall application. In orchards where leaf curl is serious, it would be a good plan to use 8–8–50 bordeaux.

Peach Rust.—Rust on peaches is caused by the fungus *Tranzschelia punctata* (Pers.) Arth. (fig. 11). The disease is generally more serious on midsummer than on late varieties. It attacks twigs, leaves and fruit. The twig lesions are elongated, brown areas surrounded by a darker zone. In these areas small pimples appear, which give off brown masses of spores. On leaves the spots are small, yellow, and angular, being

equally apparent from both sides of the leaf. On the fruit the infected areas are round and sunken with green centers, from which arise small, brown pimples or spore pustules.

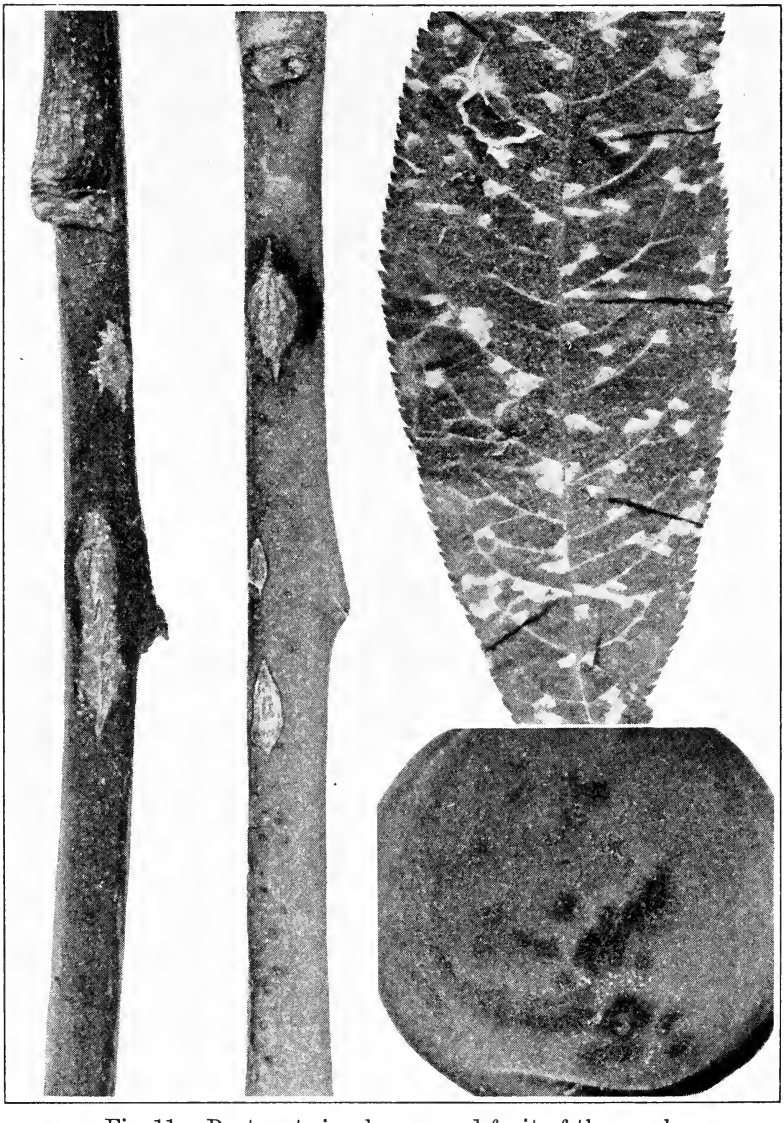

Fig. 11.—Rust on twigs, leaves, and fruit of the peach.

Twig infection occurs during the winter, and the lesions appear before the leaves unfold in the spring. Although not in themselves the cause of serious damage to the crop, they furnish the spores for leaf and fruit infection. They are controlled by applying liquid lime-sulfur, 6 gallons

to 100 gallons of water, in early fall (October 15 to November 1). In cases where twig infection is not controlled, fruit and leaves may be protected by applications of liquid lime-sulfur, 1 gallon to 100 gallons of water at intervals during early summer.

Fig. 12.—Oak root fungus between the bark and wood of a root. Note the whitish, fan-shaped mycelial layers.

Oak Root Fungus or Armillaria Root-Rot.—This disease is caused by the fungus *Armillaria mellea* (Vahl.) Quel. (fig. 12). It attacks the roots and crowns of trees. The aboveground symptoms are a pale, green foliage, stoppage of growth, and finally death of the tree. Though certain other diseases may be confused with armillaria root rot, the pres-

ence of the yellowish-white, leathery, fan-shaped mycelial layers between the bark and wood of the affected parts identifies the disease (fig. 12). Frequently, but not always, dark brown to black, root-like strands or rhizomorphs will be found along the surfaces of diseased

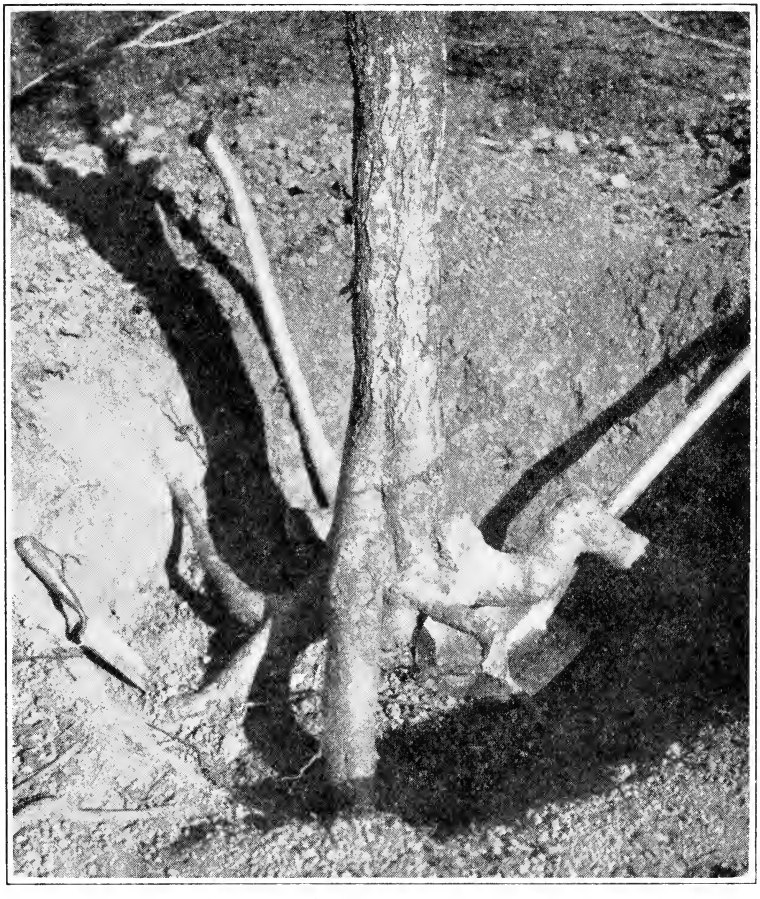

Fig. 13.—Method of exposing the crown and roots of a tree when inspecting for oak root fungus.

roots in the surrounding soil. It is by these rhizomorphs that the fungus spreads from the roots of diseased trees to those of adjacent healthy trees. Though the fungus is frequently present in virgin land as a parasite on the roots of native trees, particularly oak, infected spots may develop in soil where pieces of diseased roots have been allowed to fall. It is therefore important in removing diseased trees that all infected parts be destroyed.

Once the fungus is established in an orchard there is no certain method of eradication. Carbon disulfide has been used to kill the fungus in the

southern California citrus soils with a fair amount of success. It has not, however, given encouraging results in deciduous orchards of central California. Particularly is this true of heavy, wet soils.

Preventing spread of the fungus from diseased to healthy trees by digging trenches or constructing underground barriers has been found impractical. The life of trees surrounding an infected soil area has, however, been prolonged by exposing the crown and main roots (fig. 13), removing infected roots, and sterilizing the cuts with a solution of 1 part corrosive sublimate, 250 parts denatured alcohol, and 750 parts distilled or rain water. The crown and roots are then left exposed for a month or more during the summer to permit the drying out of any diseased area which was not removed. By repeating the inspection every year one can detect the fungus as it extends inward along the roots in time to prevent it from reaching the crown.

Since most trees and shrubs are attacked, there are only a few that can be planted in infected areas. The French pear, the fig, and the northern California black walnut are considered highly resistant. Apples are less susceptible than stone fruits, and Myrobalan plum is less susceptible than peach, although not sufficiently so to permit their use in badly infected soil. Where none of these fruits are desired, the land may be planted to most field or truck crops except potatoes and rhubarb.

Bacterial Gummosis or Bacterial Canker.—This disease is caused by the bacterium *Pseudomonas cerasi* Griffin. This disease may, at times, become very destructive in varieties such as Phillips Cling, Elberta, Alexander, and occasionally Levi. The most noticeable symptoms are elongated, gum-exuding areas of dead bark on limbs and trunks. Less frequently buds, leaves, and blossoms are attacked. The cankers enlarge during late fall, winter, and spring, gradually girdling branches of trunks, so that the entire tree or portions of the tree will fail to come into leaf; or, if they come into leaf, will die shortly thereafter. In certain cases cankers may exude little or no gum, the affected tissue being instead brown, moist, and sour smelling. This manifestation, commonly known in certain sections as "sour-sap," is not to be confused with sour-sap resulting from killing of roots and crowns by other agencies. In the case of the bacterial disease the roots are not affected; new shoots frequently start from below the union of affected trees.

No effective control is known although, in cases where the disease is just starting, considerable benefit may be derived from cutting away all of the diseased bark area. Bordeaux paste or some other good protective is then used to cover the cuts.

Crown Gall.—The bacterium *Bacterium tumefaciens* S. and T. (fig. 14) causes the tumors termed crown gall. The symptoms are rough;

woody, irregular-shaped enlargements of various sizes on roots, crowns, and occasionally on limbs. Badly affected trees bear a poor crop of light-green leaves, shoot growth is lessened, and death may follow.

Fig. 14.—Crown gall on the roots of a peach tree.

The bacteria attack a wide range of trees, shrubs, and even herbaceous plants; they may, in consequence, be present in soils on which these plants have grown. Virgin grass lands are, on the other hand, less apt to contain the bacteria. Since many of the commercial peach varieties such as Muir, Salwey, and Elberta are highly susceptible, it would be well to avoid planting them in soils formerly growing such crops as grape, quince, blackberry, raspberry, and almond. Before the nursery trees are

placed in the soil they should be carefully inspected, and any trees with galls should be discarded and burned. Avoid wounding trees near the crown after they are placed in the orchard.

When trees in the orchard are found to be diseased, some benefit is obtained by removing the soil from around the crown, cutting out the galls and bark tissue surrounding the galls, and covering the wounds with bordeaux paste. This is, of course, a measure justifiable only with trees that are profitable producers; it cannot be relied upon to rehabilitate trees in the last stages of the disease.

NONPARASITIC DISEASES AND THEIR CONTROL

Little-Leaf.—Peach trees in certain locations are badly affected with little-leaf or rosette. According to studies by W. H. Chandler and others of the University of California, little-leaf may be remedied by zinc applications. Affected trees have responded to zinc sulfate used in various ways. Soil treatment, injections, spraying, and driving zinc metal into branches have all been used. As investigations are not complete, definite recommendations cannot yet be made.

Gumming and Split-Pit.—Gumming seems to be a physiological disorder of the fruit, characteristic of the Phillips Cling variety. Although the exact cause is still unknown, satisfactory control may be obtained by delaying the thinning until most of the gumming has occurred—that is, until about 5 weeks after the pit has begun to harden and to change color on the tip and suture side. Delaying the thinning until this time will prevent the appearance of much of the gumming and permit the removal of those fruits which have gummed. In years of a light crop, when the gumming on the Phillips Cling will be serious, thinning should be delayed fully 5 weeks after the pit begins to harden. In years of heavy crops it should be done at least 10 days earlier than this. Split-pit seems to be definitely associated with a light crop and with rapid growth rate of the fruit. Under these conditions certain varieties which split worse than others are apt to produce a high percentage of split-pit fruits.

THE CONTROL OF INSECTS[22, 23]

Chewing insects remove and swallow parts of the plant surfaces. They are controlled by the application of stomach poisons. The sucking insects, on the other hand, withdraw the plant juices from the interior and are therefore not subject to control by poisons on the surface of the leaves,

[22] This section was prepared in coöperation with E. O. Essig, Professor of Entomology and Entomologist in the Experiment Station.

[23] For further discussion see: Essig, E. O., and W. M. Hoskins. Insects and other pests attacking agricultural crops. California Agr. Ext. Cir. 87:1–155. 1934.

bark, or fruit. Instead, some material must be applied directly to the insects and thus cause death by contact. Such materials are called contact insecticides.

A few insects of the peach are not readily controlled by either contact or poison materials, but require special treatment.

Pacific Peach Tree Borer.—An insect which does serious damage to peach trees in certain counties is the Pacific peach tree borer (*Aegeria*

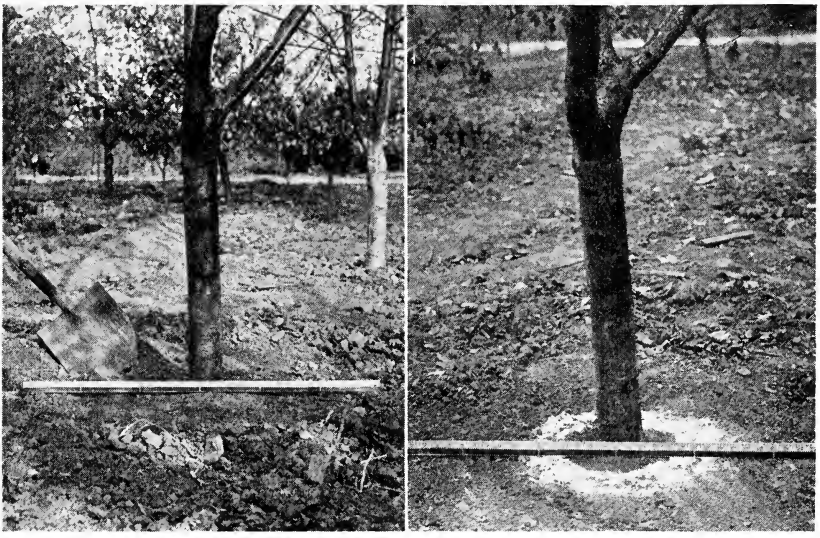

Fig. 15.—Using paradichlorobenzene by the ring method for control of the Pacific peach tree borer. Left (first step): leveling the surface of the ground for a space of 2 or 3 feet in diameter about the tree. Right (second step): the paradichlorobenzene applied in a ring 2 or 3 inches wide, the inside about 3 inches from the bark of the tree. (From Bul. 411.)

opalescens Hy. Edw.). The dark, wasp-like moth lays its eggs in the early spring on the trunk of the tree. The larvae, which hatch in 15 to 30 days, burrow into the base of the trunk and into the main roots and may girdle the tree, and kill it. Gum and frass indicate the presence of the borer. It may be controlled by using paradichlorobenzene. This crystalline material is sprinkled in a circle around and near the base of the tree and covered with soil (fig. 15). The heavy vapor penetrates the soil and the burrows, killing the insects. The material should be applied in the late summer and fall when the soil is warm and the moisture not excessive, October being the best month.

Western Flat-headed Borer.—The insect known as the western flat-headed borer (*Chrysobothris mali* Horn.), although more commonly thought of as a pest of apples, does occasionally attack peaches. The beetles lay their eggs in sunburned or injured areas especially, or on

trees showing low vigor. The whitish larvae, having a flattened portion just behind the head, hatch in the spring, mine the inner bark and sapwood, and may girdle the branch or trunk. Prevent sunburn by proper pruning and whitewashing, and avoid injuries or wounds to the tree. Keep the tree vigorously growing by supplying sufficient water and thus discourage egg laying by the beetles. When borers are in the tree the only feasible control is to dig them out. Use tree protectors on young trees, especially in nonirrigated areas.

Fig. 16.—Nematode infestation on peach roots. This condition should not be confused with crown gall (fig. 14).

Nematodes (*Eelworms*).—Of the various species of nematodes, the common garden or root-knot nematode, *Heterodera marioni* (Cornu), is the one that is serious on peaches in some sections (fig. 16). It causes rounded, irregular, fleshy swellings or knots on the tender roots. If it is abundant, the roots may become much distorted and swollen, and the trees may ultimately die. Nematodes are worse on sandy soil. There is no control for affected trees. Resistant rootstocks appear promising. (See "Rootstocks for Peaches," p. 19.)

Peach Twig Borer.—The peach twig borer (*Anarsia lineatella* Zell), a small reddish-brown caterpillar, about ½ inch long, burrows into and kills buds and twigs and may seriously infest the fruit. The larvae hibernate just beneath the outer bark in the crotches of the framework and smaller branches and emerge in the early spring to infest buds and new shoots. Later they change to tiny moths that fly about the orchard depositing eggs. These give rise to a second and to subsequent generations of caterpillars which infest fruit. By their feeding the late caterpillars

sometimes destroy large amounts of marketable fruit (fig. 17). The standard control for peach twig borer has been delayed dormant lime-sulfur, 8 gallons with water to make 100 gallons of spray, applied from the time the blossom buds are begining to show pink until the first blossoms open. More recent investigations have shown that basic arsenate

Fig. 17.—Fruit damaged by peach twig borer, showing surface injury. (From Bul. 355.)

of lead, 3 pounds to 100 gallons of water, will effectively control the twig borer. In order to avoid poisoning the honeybee, this spray should be applied when at least two-thirds of the blossoms have fallen. A combined spray for twig borer and mildew which has been successfully used is as follows: 3 pounds dry basic arsenate of lead, ½ to ¾ gallon liquid lime-sulfur, and 5 pounds wettable sulfur with water to make 100 gallons of spray, applied just after the petals have fallen.

Leaf-Eating Caterpillars.—Various kinds of chewing insects will eat peach foliage, including cankerworms, red-humped caterpillars, tent

caterpillars, and leaf rollers. Different methods of control may be used; but in general, spraying with basic arsenate of lead, 3 pounds to 100 gallons of water, at the time the insects first appear will give good results. *Caution:* No one should apply summer sprays with arsenicals without consulting some competent authority such as the local farm advisor.

Pyrethrum or buhach powder, 2½ to 5 pounds soaked overnight in 5 gallons of water, and then added to enough water to make 200 gallons of spray, has been effective in the control of cankerworms.

Black Peach Aphid.—The black peach aphid (*Aphis persicae-niger* Smith), a shiny-black plant louse, appears in great numbers on tender shoots and fruit in the spring. It is controlled by spraying with 1 pint of nicotine sulfate and 4 to 5 pounds of fish-oil soap to 100 gallons of water; or by dusting with nicotine dust as soon as the insects appear.

Scale Insects.—Various scale insects such as San Jose scale (*Aspidiotus perniciosus* Comst.), the black scale (*Saissetia oleae* Bern.), and the brown apricot scale (*Lecanium corni* Bouche) occasionally become serious pests on the peach. Oil sprays applied in the winter months (December and January) may be necessary. Tank-mix oils[24] are effective and economical. Dormant lime-sulfur will control San Jose scale, but not the others.

Red Spiders.—Three forms of red spiders may infest peach trees: the brown mite (*Bryobia praetiosa* Koch), the Pacific mite (*Tetranychus pacificus* McG.), and the common red spider (*Tetranychus telarius* Linn.). The first overwinters in the egg stage on the trees. Adults appear in early spring and may become numerous during the summer. They are rarely troublesome; but when the problem is serious a heavy oil spray, applied in the winter months, will control this form. The common red spider and the Pacific mite, on the other hand, which are most widely destructive, hibernate as adults in the soil or crevices on the bark of trees as well as on other plants. Adults of these forms appear about May or June and continue feeding and egg laying throughout the summer. Summer oil, lime-sulfur, sulfur sprays, and sulfur dusts seem to be effective. Red spiders are less injurious in orchards that are well supplied with soil moisture than in orchards that are suffering from drought. Control measures for the last two species should be applied before defoliation occurs. The grower should carefully watch his trees, for the mites first appear on the tops of the branches and in the tops of the trees.

[24] Borden, Arthur D. The tank-mixture method for dormant oil spraying of deciduous fruit trees in California. California Agr. Exp. Sta. Bul. 579:1–20. 1934.

SUMMARY OF SPRAY PROGRAM

Of the eight diseases discussed, five (peach blight, leaf curl, rust, brown rot, and mildew) lend themselves to control by spraying or dusting, whereas three (gummosis, crown gall, and oak-root fungus) do not. Two or more diseases of the former group—those controllable by fungicides—may be present in an orchard. The problem then becomes one of obtaining the best possible control with the fewest applications. Three of these five diseases, peach blight, leaf curl, and rust, are of such a nature that fall sprays will give a high degree of control. The recommendation for rust is an application of lime-sulfur between October 15 and November 1; that for peach blight and leaf curl is an application of bordeaux mixture after leaf fall (generally November 15 or a little later). Fortunately, rust is not a problem in most years, and, in addition, is controlled to a certain degree by bordeaux mixture. Unless it has been severe the past season, the fall spray should be timed for the control of peach blight and leaf curl, using bordeaux mixture 5–5–50. Should rust appear on the twigs the following spring, lime-sulfur, 1–100, can then be used to protect fruit and leaves.

One application of spray or dust cannot be timed to give the most effective control of both brown rot in blossoms and powdery mildew. When these two diseases are present, spray with bordeaux mixture, 8–8–50, at the pink-bud stage; later, at the time the fruit sets, dust with sulfur or apply the combined lime-sulfur wettable-sulfur spray. The former for brown-rot control; the latter for mildew. The mildew application can be expected to aid to a certain extent in controlling brown rot, but the bordeaux application for brown rot will have little effect on mildew. Early summer applications of dusts for mildew will help somewhat in controlling brown rot but cannot be expected to remain effective until the fruit ripens. See the discussion of brown-rot control.

Of the various insects attacking peaches, the peach twig borer is the only one that requires a regular spray program: (1) a delayed dormant lime-sulfur spray—8 gallons of the stock solution with water to make 100 gallons, applied from the time the blossoms begin to show pink until the first blossoms open; or (2) a basic arsenate of lead spray, 3 pounds in 100 gallons of water, applied after the petals have fallen from two-thirds of the blossoms. As stated earlier, if lime-sulfur is used for control of twig borer, the bordeaux spray for brown rot should be omitted. The lime-sulfur should be applied in the pink-bud stage for best blossom-blight control. Summer sprays should be made only after consultation with local authorities such as the county farm advisor. The control of

the other peach insects depends upon their appearance and the amount of damage resulting from their attacks.

Since the severity of the disease and insect attacks will vary with locality and with the susceptibility of the peach varieties planted, each orchard presents its own peculiar problems. These problems can be met only by a first-hand acquaintance with the situation. As a consequence, the local farm advisors are in a good position to decide what control program to adopt.

CONTROL OF SOME OTHER PESTS[25, 26]

Pocket Gophers.—Methods of control include (1) trapping, (2) poisoned baits, (3) flooding, (4) gassing, and (5) protection of the gopher's natural enemies, especially the barn owl and the gopher snake. Persistent use of two or more of these methods will eliminate gophers on entire areas. Traps are always useful and effective, not only for individual gophers but also for general use where gophers are abundant. Placing of poisoned baits in burrows is useful when gophers are numerous over a large acreage. When an orchard is irrigated, it is easy to kill the gophers that are flooded out. Gassing is less effective with gophers than other methods but finds some use.

Ground Squirrels.—These animals are controlled chiefly by poison, gas, traps, and shooting. Strychnine-coated grain, used with discretion, reduces ground squirrels during late spring, early summer, and autumn. Gassing is best practiced when the soil is damp. Traps are useful for individual squirrels. If squirrels are climbing trees to gather fruit, a metal collar around the trunk of the tree will eliminate this sort of damage.

Rabbits.—Rabbits, sometimes abundant, may damage orchards, especially of young trees, by gnawing the bark and eating young shoots. Hunting, the use of repellent paints or sprays, and exclusion fences are the principal means of protection.

COST OF GROWING PEACHES

The costs of growing peaches are markedly modified by several variable factors. The yield per acre more widely influences the cost per ton than any other single factor. The lower the yield per acre, the higher the cost per ton. A cost and efficiency study made by the Agricultural Extension Service illustrates this fact. In 1933 sixteen orchards of cling peaches

[25] This section was prepared by Tracy I. Storer, Professor of Zoölogy and Zoölogist in the Experiment Station.

[26] A fuller discussion of these pests will be found in: Storer, Tracy I. Control of injurious rodents in California. California Agr. Ext. Cir. 79:1–55. 1933.

comprising a total of 653 acres, in which cost studies were conducted,[27] were divided into the more profitable group and the less profitable group; there were eight orchards in each group. The net profit for the more profitable group was $98.86 per acre; for the other group, $5.99. This difference in profit was almost entirely from yield. The more profitable group had an average yield of 13.6 tons per acre; the less profitable group, 8.6 tons.

TABLE 6

ESTIMATED LABOR REQUIREMENTS PER ACRE FOR FULL-BEARING CLING PEACHES*

Operation	Hours per acre		
	Man	Truck	Tractor
Pruning	45.0	....	....
Brush disposal	4.0	....	1.3
Planting covercrops	1.0	....	....
Fertilizing	2.0	0.7	....
Fall spray	4.5	....	1.5
Early spring spray	4.5	....	1.5
May arsenate of lead spray	4.5	....	1.5
Checking, 3 times	1.5	....	1.5
Irrigation, 5 times	20.0	....	....
Cultivation, 6 times, one way	5.0	....	....
Miscellaneous	4.0	0.5	....
Subtotal	96.0	1.2	12.3
Thinning	90.0	....	....
Bracing and propping	3.0	1.0	....
Picking 10 tons	100.0	....	....
Hauling 10 tons	8.0	8.0	....
Total	297.0	11.4	12.3

* Data from: Klamt, R. H., and A. Shultis. Cling peach cost and efficiency study, Sutter County. 1933. Published by the California Agricultural Extension Service.

Since actual costs have varied widely during the last few years, because of the spread in prices paid for labor, table 6 has been prepared showing the hours of labor that would be required during a year's operation of a cling-peach orchard. These data are for mature, full-bearing trees and probably represent the requirements of any well-managed orchard. Aside from some small differences, especially in thinning, the labor required in an orchard of drying or shipping fruit is almost exactly the same up to the time of harvest as that for canning peaches. More detailed information regarding the actual costs of peach growing should be obtained from the local farm advisor.

[27] Klamt, R. H., and A. Shultis. Cling peach cost and efficiency study, Sutter County. 1933. Published by the California Agricultural Extension Service.

HARVESTING AND HANDLING

The larger part of the grower's peach crop is harvested within a comparatively short period of time; and much of the profit for the year's work depends upon how well this is done and whether the crop is sold fresh, canned, or dried.

Fresh Fruit.—When suitable for market the fruit is fully developed and almost fully colored. The flesh is firm and will withstand handling. When fully ripe the peach is well colored, and the flesh is soft and so easily bruised that it will not withstand shipping. Between market ripeness and full ripeness, peaches increase in sugar. During the same period the weight of the fruit increases greatly. This fact indicates the importance of permitting peaches to remain upon the trees as long as possible and yet arrive upon the market in good condition. The grower gains in the weight of the crop by this delay, and the consumer receives a higher quality of fruit.

Under California conditions for long-distance shipment, the peaches are picked somewhat more immature than is desirable for local markets. At the packing-house all fruits are graded for maturity, color, defects, and size.[28] Most of this grading must be done by hand, but the sizing may be mechanical. In the larger packing-houses where mechanical graders are used, the fruit from field lugs is dumped on the sorting table to be graded for maturity, color, and defects. It then runs over the sizing belts, where it is mechanically sized to conform to the standardization laws. Where no mechanical grading machines are used, the fruit must be sized by hand, generally by the packer.

All fruit for distant markets is individually wrapped and packed in standard peach boxes.

The empty box is placed on the packing bench. The packer selects the fruit and starts to wrap (fig. 18*a*). He picks up a peach with the right hand and the wrapping paper with the left. In picking up the wrapping paper, he should be careful to grasp it toward one corner, which allows more paper to be finally folded over the peach (fig. 18*b*). The fruit is thrown from the right hand into the paper held in the left hand (fig. 18*c*). A little force is necessary to break down the paper and bring the corners into position for wrapping with the least amount of lost motion. The wrap is finished by placing the palm of the right hand around the fruit (fig. 18*d*). The wrapped fruit is placed in the box with the left

[28] The fruit, nut, and vegetable standardization laws found in the Agricultural Code specify standards for packed fruit. Copies of the standardization laws may be obtained from the California State Department of Agriculture or from the local County Agricultural Commissioner.

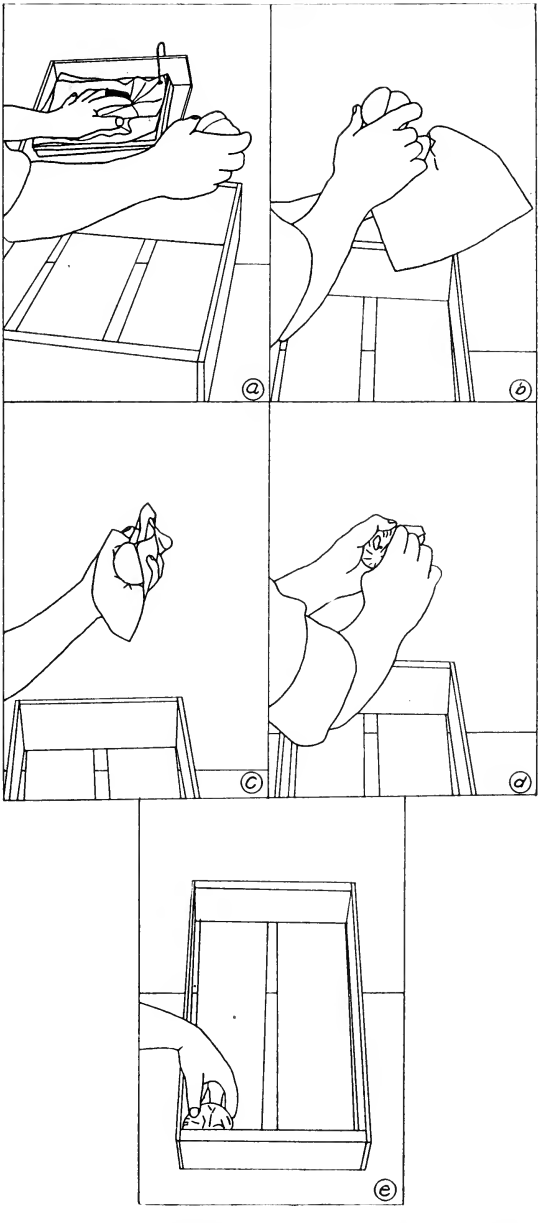

Fig. 18.—Progressive steps in wrapping peaches. The various steps are explained in the text. (From Cir. 241.)

hand, the loose ends of the paper resting on the bottom (fig. 18*e*). At the same time, the right hand is reaching for another peach.

The question may arise as to the additional time required to wrap each peach. As a matter of fact one can pack much faster by wrapping than by not wrapping; the actual time in wrapping is but a fraction of the

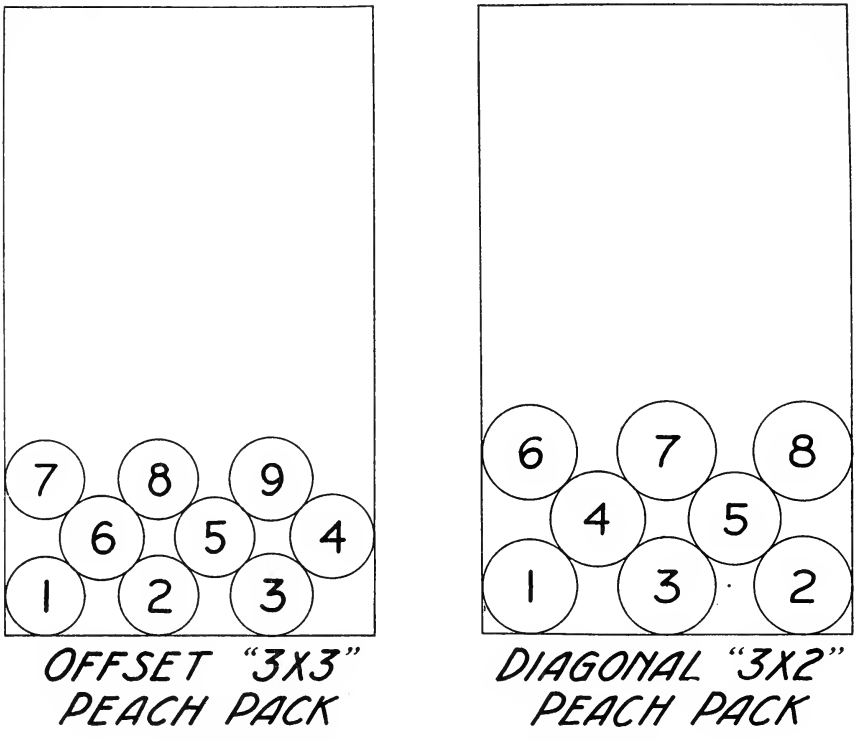

Fig. 19.—Styles of peach packs. (From Cir. 241.)

total time involved. If packed without wrapping the peaches will not remain in place so well, but with paper on them they nest tightly in place.

The size and shape of the variety will determine whether the fruit shall be packed with the stem end up or down, rather than on its cheek. With some sizes of peaches the packer will find that one method gives a better pack than another; this can be learned only from experience. Most packers, however, prefer to pack peaches with the stem end down.

Styles of Pack.—Two styles of pack are used for peaches: the "offset" and the "diagonal" styles. The offset pack ("3 × 3") is used for peaches that can be placed five or more across the box. For peaches larger than this the diagonal pack ("3 × 2") should be used. Two layers of fruit, by either style, comprise a standard pack.

The offset pack: The first peach is placed in the lower left-hand corner of the box, two others are placed equidistant in the space between the first peach and the right-hand corner, leaving the same space in the corner as between the fruits. The next three peaches are placed in the spaces formed by the first three (fig. 19). This is continued throughout the first layer, keeping the alignment perfect. The second layer is begun

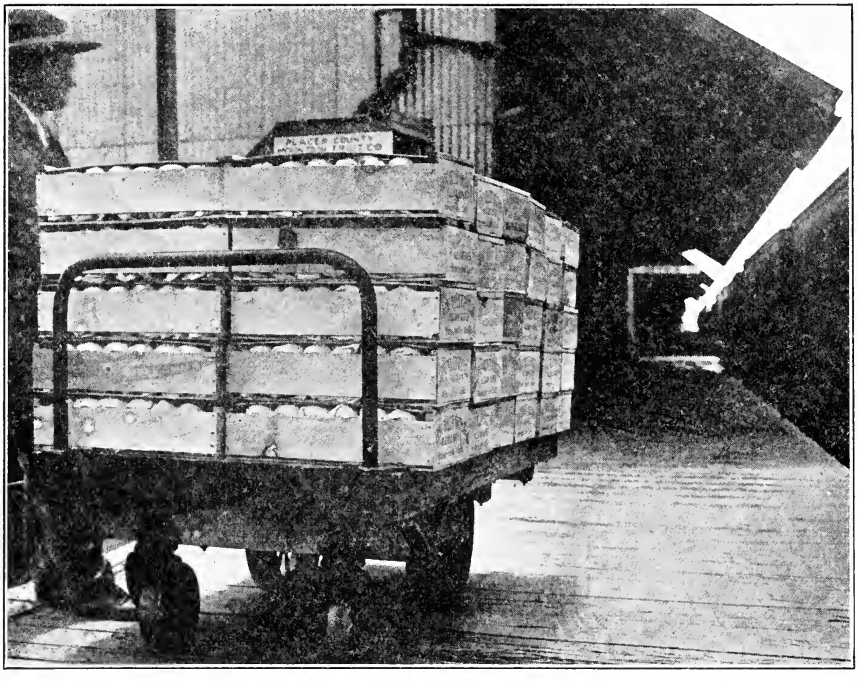

Fig. 20.—A platform truck for loading cars. Note bulge on the boxes. (From Cir. 241.)

in the right-hand corner of the box; the fruits being placed directly over the spaces formed by the peaches in the first layer.

The diagonal pack: This pack resembles the offset style except that it is started by placing a peach in each corner of the box and a third midway between. Two peaches are placed in the two spaces formed by these three, and the pack continues as described for offset (fig. 19).

With the larger sizes of peaches both layers should be carried forward together so as to regulate the height of the pack.

When the box is completed the pack should be solid and snug-fitting throughout and in perfect alignment. The completed pack should have a bulge of about ½ inch so that the box will ship well (fig. 20).

The following tabulation is helpful in determining the number of peaches per box. The packer counts the number of peaches across the

box and the number lengthwise in two consecutive rows of the pack; then he obtains the total by referring to the table. In both styles of packs the fruit is two layers deep.

Width	*Length*	*Total*	*Width*	*Length*	*Total*
3 × 3	8 × 8	96	3 × 2	7 × 6	65
3 × 3	8 × 7	90	3 × 2	6 × 6	60
3 × 3	7 × 7	84	3 × 2	6 × 5	55
3 × 3	7 × 6	78	3 × 2	5 × 5	50
3 × 3	6 × 6	72	3 × 2	5 × 4	45
3 × 2	8 × 7	75	3 × 2	4 × 4	40
3 × 2	7 × 7	70	2 × 2	5 × 4	36

Peaches smaller than 96 per box are considered too small to wrap and pack in the peach box in two layers and must be packed in three. It rarely pays, however, to wrap peaches of this size. Sometimes small peaches are shipped in plum and apricot crates.

When the packer has finished a box, he puts his packing number on it and sends it to the lidder, who inspects it to see that it is properly packed. Having nailed on the lid, the lidder stamps on the end of the box the name of the variety and number of peaches contained. The boxes are then stacked, generally ten high. For convenience in loading, boxes of the same variety and the same count should be stacked together.

Drying Peaches.—Peach drying is practiced most extensively in the Sacramento and San Joaquin valleys, to some extent in southern California, but scarcely at all along the coast or in the foothills. Only firm yellow freestone varieties, principally the Lovell, Muir, and Elberta are dried commercially. In the San Joaquin Valley peach drying begins as early as July 15 with the Muir and continues into September. In the Sacramento Valley most of the peaches are dried during August and September. The drying ratio of Muir and Lovell varies from 4 : 1 to 6 : 1, whereas the Elberta will shrink from 6 : 1 to 8 : 1. A general average drying ratio would be about 5 : 1. The average yield of dried peaches is about 1½ tons per acre.[29]

In recent years a considerable quantity of yellow canning cling peaches has been dried. In some cases the fruit is pitted, lye-peeled, and dehydrated rather than sun-dried. An excellent product can thus be obtained.

Peaches for drying are picked when they have a uniform yellow color, are fully mature, have begun to soften, though still reasonably firm, and can be easily cut with a sharp knife without losing their shape. Peaches are cut by running a sharp knife around the line of the suture so that

[29] Nichols, P. F. Methods of sun-drying fruits. California Agr. Ext. Cir. 75:1–37. 1933.

the knife blade returns to the point where the cut began. The halves of the peach are separated, the pit removed, and the two halves laid on a clean tray with the cut surfaces up (fig. 21). The full trays are placed on a low truck, and the stack when completed is transferred to the sulfuring house (fig. 22). Peaches are normally exposed for 3 to 5 hours to dense fumes of burning sulfur, used at the rate of about 7 pounds per ton of fresh fruit. After sulfuring is complete, as indicated by a cooked

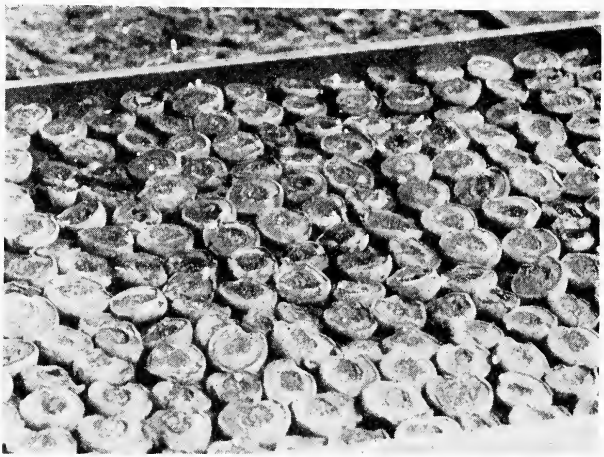

Fig. 21.—Tray of peaches in the process of drying.
(From Ext. Cir. 42.)

appearance of the flesh of average pieces about two-thirds through, the trays of peaches are transferred by truck to the dry-yard, where they are exposed to the sun.

The fruit should remain exposed to direct sunshine until it is from a quarter to half dried and has acquired a uniform color. This requires from 1 to 5 days according to the temperature and air movement. The trays should then be stacked in a staggered pile with the open ends in the direction of the prevailing winds. After 2 to 6 days in the stack the fruit will be dry enough for storage, as indicated by its leathery texture. Though the total drying time varies greatly with locality and weather conditions, it averages 8 days for peaches.

Before the dried fruit from each tray is scraped into lug or "sweat" boxes, all discolored pieces, pits, or other foreign matter should be picked out. This important culling can be done much more efficiently and economically now than later. The dried fruit is then transferred from the dry-yard to the storage building, where it is "sweated" so as to equalize the moisture content and is held several weeks before delivery to the packer.

Canning Peaches.—In the use of peaches for canning, the fruit is shipped or hauled direct to the cannery. The canners have certain requirements as to the condition of the fruit and instruct the grower regarding the desired maturity for harvest. Fruit of 2⅜ inches or more in diameter is demanded for grade 1; it must be firm, ripe, clean, and

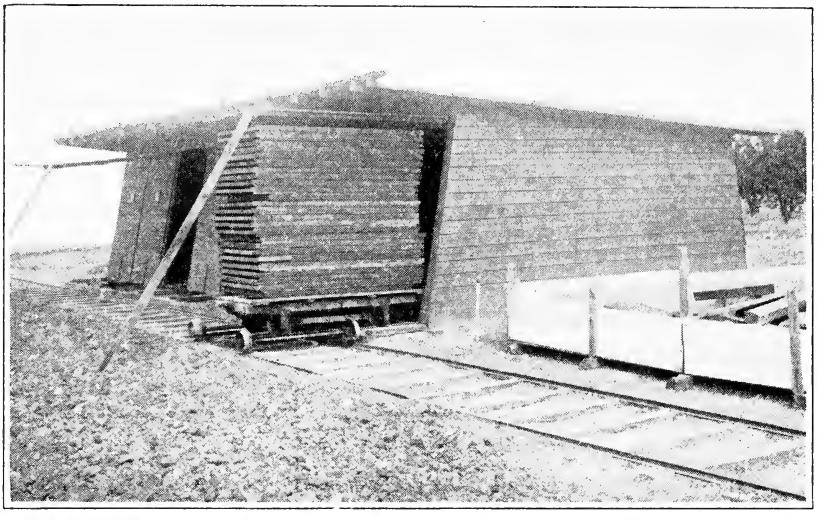

Fig. 22.—Eight-unit sulfur house. Note transfer and tray cars.

free from blemishes. Recently the canners have not accepted any but No. 1 fruit. Under certain conditions, however, they may accept fruit that does not meet the No. 1 specifications. When canned the fruit must be of a pleasing golden color, firm texture, and good quality.

NECTARINES

Since the general cultural practices for nectarines are the same as for the peach, the reader is referred to the headings on peach culture for general information on production.

Table 7 gives the acreage of nectarines for the leading counties of the state in 1932. The greatest acreage is in Fresno County, where the fruit is mainly shipped fresh to local markets. In the upper Sacramento Valley, particularly from Tehama County, large quantities of nectarines are shipped to eastern markets, especially of the Quetta variety. In 1934 the total acreage of bearing trees was 2,096 and of nonbearing, 383.

The nectarine can usually be grown wherever the peach is grown. There are, however, some exceptions. In certain sections of California where grass or grain thrips are serious, nectarine production is practically impossible. The thrips, being pollen feeders, will work in the flow-

ers and often completely destroy the pistil, preventing the set of fruit. If the injury is less severe the fruits are so badly deformed as to be unmarketable. Even in sections where no thrips injury occurs on peaches, the nectarine may be rather badly scarred apparently because it lacks the pubescence which, on the peach pistil, repels the thrips.

TABLE 7

ESTIMATED ACREAGE OF NECTARINES IN LEADING COUNTIES OF CALIFORNIA, 1932

County	Bearing acres	Nonbearing acres
Contra Costa	104	20
Tehama	150	..
Yolo	150	5
Fresno	502	472
Madera	172	12
Tulare	190	77
Other counties	264	184
Total	1,532	770

Source of data: California Coöperative Crop Reporting Service, personal correspondence.

VARIETIES OF NECTARINES FOR THE ORCHARD

The same considerations in choosing varieties of peaches hold for nectarines and need not be repeated here.

Most of the varieties now grown are, in order of ripening, as follows: Cardinal, Early Rivers, Dixie, Lord Napier, New White, New Zealand Seedlings (Ansenne, Diamond Jubilee, Gold Mine, Muir's Seedling, New Boy, Sure Crop), Lippiatt's Late Orange, Gower, Humboldt, Quetta, Stanwick, and Spanish. The description of some of these varieties follows:

Cardinal.—Very early, medium-sized, highly colored, white-fleshed, semifreestone nectarine; the earliest variety to ripen. Very attractive and of fairly good quality.

Dixie.—A Texas variety; very attractive, highly colored fruit, shaped like a Honey peach, with a similar flavor; flesh firm, white; a freestone.

Early Rivers.—An English variety; medium-sized, crimson-colored on exposed cheek; flesh greenish white, tender, juicy, practically free; quality very good.

John Rivers.—An English variety, very similar to Early Rivers but more highly colored and a few days later in ripening.

Gower.—A California variety introduced by the Fancher Creek Nursery. Medium-sized, highly colored, white-fleshed, a freestone; flavor fairly good.

Humboldt.—An English variety; medium-sized, yellow-skinned, blushed on exposed surface; flesh firm and yellow—a freestone; highly flavored, fair quality. It appears to be subject to late foliation.

Lippiatt (Lippiatt's Late Orange).—Introduced from New Zealand by the U. S. Department of Agriculture. Fruit medium in size, roundish; skin yellow, highly blushed on exposed cheek; flesh yellow, firm, juicy, subacid, good quality; red at pit. Stone medium-sized, free. At Davis the fruit drops badly before maturing; similar reports from some other sections.

Lord Napier.—An English variety, medium to large, cream-colored with blushed cheek. Flesh white, tender, juicy; freestone, high quality; heavy bearer; especially good for home orchards.

New Zealand Seedlings.—Six named varieties as follows: Ansenne, Diamond Jubilee,[30] Gold Mine, Muir's Seedling, New Boy, and Sure Crop—all introduced by the U. S. Department of Agriculture from New Zealand. These varieties are so similar that there seems to be no justification for all of them. Fruit medium in size; highly blushed; white flesh, tender, juicy, mildly subacid; best for dessert and home use; freestone, red at pit. Different varieties are propagated by several California nurserymen.

New White (Large White).—Fruit medium in size, nearly round; skin white, sometimes slightly tinged with red; flesh white, tender, very juicy, with rich vinous flavor; stone small and free.

Spanish.—Fruit large, nearly round; skin greenish with slight blush on exposed cheek; flesh white, rather firm, juicy with vinous flavor, red at the pit; stone rather large and free.

Stanwick.—An English variety originating in 1843 from seed brought from Syria. Fruit large, roundish; skin greenish with red blush; flesh white, tender, juicy, of fair quality; freestone, red at the pit. Fruit tends to drop before mature. Affected by delayed foliation.

S.P.I. 30648.—Introduced by the U. S. Department of Agriculture in 1911. Fruit large, greenish white, blushed; flesh white, red at pit; firm, meaty, juicy, quality good; very late maturity; clingstone. Possibly of value for late shipping.

Quetta.—Introduced by the U. S. Department of Agriculture from India. Fruit large, round, greenish-white skin, highly blushed; under favorable conditions, almost solid red. Flesh white, very firm, meaty, juicy; quality good; very red at pit; a clingstone. An important shipping variety in the Sacramento Valley.

[30] This variety seems to be little affected by delayed foliation.

HARVESTING AND HANDLING OF NECTARINES

At present most of the nectarines are shipped to local or distant markets for dessert purposes. Instead of wrapping the individual fruits (for distant shipment) and packing them in a standard peach box (see section on packing of peaches), some growers use egg-case dividers in the peach box and place the unwrapped fruit in the cells, two cell layers deep. The layers are separated by placing a cardboard between them. Fruit for local markets is generally sold unpacked in various-sized lug boxes.

Few nectarines are dried commercially, although they make an excellent product.

At present nectarines are not commercially canned because the varieties now grown are not adapted to the purpose. The canner desires a firm, yellow-fleshed variety that may be treated like apricots. From present peach and nectarine-breeding experiments by the Division of Pomology, a desirable commercial canning variety may be developed. Several of the varieties tested are outstanding for home canning, particularly the Gower and any of the New Zealand seedlings. Being tender, they cook up in canning, but the flavor is delightful.

ACKNOWLEDGMENTS

The authors are indebted to R. H. Klamt, Farm Advisor of Sutter County, A. A. Jungerman, Farm Advisor of Stanislaus County, and E. F. Serr, Assistant Farm Advisor of San Joaquin County, for helpful information and suggestions. Certain sections in Extension Circular 42, *Peach Culture in California,* by E. L. Overholser and W. P. Duruz, have also been drawn upon by the authors in the preparation of the present manuscript.

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